Volume 63 American Machinist Number 7
New York, August 13, 1925

Getting the Most Out of Your Machine Tool Dollar

"Every three months a physical review is made of our equipment, this check being made to determine what equipment is necessary for greater production, replacement of present equipment with machines more suitable for the work, and replacement of worn out equipment."

By E. R. Norris
Director of Works Equipment
Westinghouse Electric and Manufacturing Co.

LARGE manufacturing concerns producing lines of apparatus that require the use of many machine tools of different types and sizes must give close attention to the purchase, use and disposition at the proper time, of the tools installed.

In the manufacture of electrical apparatus, almost all types of standard machine tools, both large and small, are employed. Special machines, designed to perform a single operation, or several well defined operations, also are used. It is evident that the most suitable tools for the service intended must be installed and maintained to insure economical manufacturing costs.

The plants of the Westinghouse Electric and Manufacturing Co. maintain a cross-index card record of all equipment installed, and the main works at East Pittsburgh maintains what might be called a master record, covering the installations in all of the plants. The cards are cross-indexed by works tool number, location, and classification of machines. Thus, there is available a record that gives information pertaining to character of machines, type of drive, purchase price, date of purchase, where located and any transfers that may have been made. When the equipment is finally disposed of, the record shows whether it was scrapped or sold.

These records are maintained under the guidance of the Director of Works Equipment. So is a file as complete as can be obtained, of all circulars, catalogs and other information pertaining to manufacturing equipment. This department endeavors to keep the plants that are interested in manufacturing equipment fully advised on all matters pertaining to such equipment that may be offered by any outside suppliers. In this way it acts as a clearing house for incoming information of this character, receiving all proposals for equipment and finally acting on the purchase, working in conjunction with other departments devoting their time to this work, connected with the different plants.

At each of our plants there is a department reporting to the Works Manager, which devotes its entire time and effort to the study of manufacturing methods and equipment. This department controls a group of demonstrators who are practical men each specializing on one type of machine tool and making a study of what the market has to offer in his particular line. The demonstrators instruct new operators, make demonstrations, and continually aim to lower manufacturing costs by improving methods. When we purchase new tools that are in any way special, or are for a new line of manufacture, the demonstrator fully determines their fitness for the work intended before releasing them to the operating department. When the set-up is complete and the machine ready for operation, the demonstrator instructs the workman chosen to run the machine, showing him how to perform the work in the proper manner and time.

The demonstrators, in a sense, act as salesmen for the machines they represent, in an effort to improve manufacturing conditions. The entire works is their field and they are in competition with one another. For example, certain types of machines are suitable for performing the same operation, and it is the duty of a given demonstrator to show by actual results that the machine he represents is best for the service intended. This arrangement results in beneficial comparisons,

such as milling machines versus surface grinders, engine or turret lathes versus vertical mills, and single-purpose drills versus multiple or gang drills.

I believe that it can be seen readily that these men, operating on the inside, have a great opportunity for constructive work in the way of determining the best methods. It seems to me that the policy is better than always depending upon the suppliers of machine tools to furnish the information for the purpose of interesting us in their equipment. We appreciate, and in many cases take advantage of, the efforts made by machine tool builders in furnishing us with information of this kind, and are always ready to receive their data.

In fact, when a job shows signs of becoming very active from a quantity standpoint, warranting consideration of special equipment, we frequently submit drawings or send samples to tool manufacturers for comparison estimates. When the estimates are received, a comparative labor cost is compiled and compared with existing costs and methods. Very often a saving shown by the use of a different tool does not work out to advantage when the production requirements are limited or are short-lived, and very often the cost and upkeep of small tools and fixtures prohibit their use.

Machine Tool Supervisors

In addition to the demonstrators, we have another group of men, known as Machine Tool Supervisors, reporting to the superintendents of the various divisions. These men are expected to have full knowledge of machines coming under their control, in respect to their condition and suitability for the work. Every three months a physical review is made of our equipment, at which time these men, through their superintendents, advise the general supervisor of equipment as to their needs for additional equipment, this check being made to determine what equipment is necessary for greater production, replacement of present equipment with machines more suitable for the work, and replacement of worn out equipment.

To aid the supervisors in selecting the proper tools, a record is maintained, in the machine repair department, of each tool, showing the make and cost, the repairs and adjustments made and the cost of such repairs and adjustments. At any time it is possible to go to this record and ascertain what repairs have been made to a machine tool since its installation. It is a record that is very valuable to the works equipment department in selecting new equipment, as any weakness in machine tool design or construction is indicated by the frequency of repairs to certain parts.

The final recommendation of the machine tool supervisor is made on a form called "Request for Equipment," and submitted by the General Tool Supervisor through the Works Manager, to the Director of Works Equipment. This procedure enables the director of works equipment to consider the requirements of the various divisions of the works as a whole, and he can then determine whether or not tools that have served their purpose in one department can be used to advantage in another; what tools shall be sold as used equipment and what tools scrapped. Because this check is made every three months, and because during each check each tool in our works is investigated by those directly interested, it is our belief that by this method and by the use of the record of the cost of repairs, adequate arrangements have been provided to determine when equipment should be replaced.

The form "Request for Equipment," referred to in the preceding paragraph, is addressed to the director of works equipment. It provides for a description of the equipment wanted and includes a list of five reasons for the request, with a space for the amplification of any or all of them. These reasons are (1) increased production; (2) saving in cost of manufacture; (3) replacement; (4) change in design; (5) new line of apparatus. The form carries the following instructions: "If equipment wanted is a duplicate of equipment we now have, specify our tool number and list exceptions, if any. If equipment is not like any we have, give complete description, specifying extra parts, if any are required. Reasons for request should be completely filled out."

The life of a machine tool depends upon the class of work it has been doing and the care it has received and can be determined only by actual observation and the checking up of the machine itself.

I am not in accord with the following statement which appeared on page 2, Vol. 62, No. 24 of the *American Machinist:*

> "A machine tool may be literally as accurate and productive as the day it was built and yet be a distinct liability. If it is more than five years old it is almost a certainty that there is a tool which will do the same work faster, with more precision, and without costly repair charges."

The introduction of high-speed steel made many machines obsolete, replacement was in order and was the profitable thing to do. The advent of high-speed steel was, however, a pronounced and unusual occurrence. While it is true that many machines have undergone remarkable development of late, I do not believe that development has been carried to such an extent as to make a large percentage of machines in use obsolete after five years of proper use. Nor would any salesmen of machine tools be willing to admit that, after five years of use, repairs would warrant replacement.

Summary

What I have said, as descriptive of the equipment policies of the Westinghouse Electric and Manufacturing Co., may be summed up in a few sentences:

Close attention must be given to the selection, purchase, use and disposition of equipment.

Complete records of equipment installed, and that available on the market, are essential to efficient control.

Demonstrators, reporting to the department in charge of the study of manufacturing methods and equipment, furnish most of the data from which the selection of equipment is made.

Machine tool supervisors review the equipment every three months, to determine the necessity for additional and replacement equipment.

Requests for equipment from all plants clear through the office of the director of works equipment.

[The preceding article is the eighth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article, by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793, Vol. 62. The fifth, by G. T. Christopher, Factory Manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. The seventh, by T. C. Vail, superintendent, the Spicer Manufacturing Co., was published on page 175, Vol. 63. Other articles on the same subject will be published in forthcoming issues.]

Five Air-Brake Pump Operations

Special Correspondence

Vertical and horizontal boring and milling machine work with special fixtures and tooling. Marking center lines as locating points for future operations

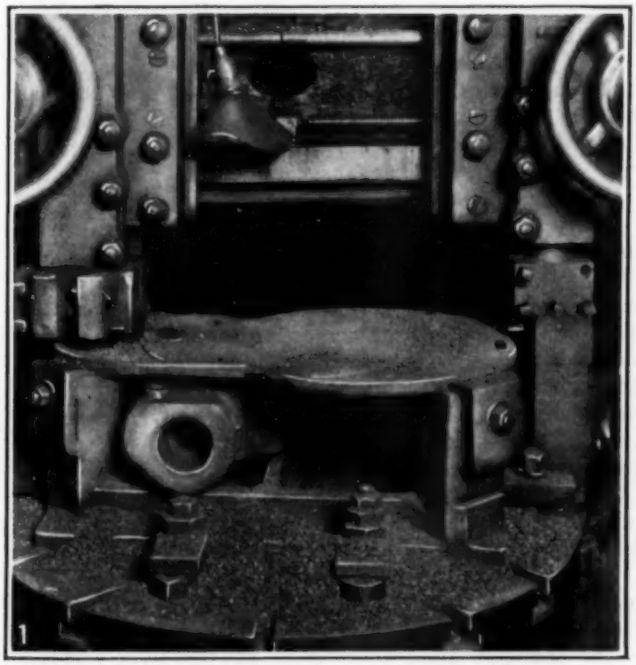
THE upper cylinder head for the cross-compound air pump has a number of machining operations, a few of which are illustrated herewith. The upper head is shown in position on a Bullard boring mill in Fig. 1, in which the holding fixture used can be seen, as well as the type of clamp used for holding the work in position. It will be noted that the upper edge of the clamp is sharp so as to bite into the casting at about the center of the flange and that the lower end fits in a groove in the fixture. Tightening the bolt tends to pull the casting down on the fixture and also to hold it against any lifting tendency due to the action of the cutting tools. It will be noted that the tool at the left is taking the roughing cut while the broad-faced tool at the right will be used for finishing.

In boring for the controlling mechanism, the head is reversed and the casting centered as shown in Fig. 2. The tooling shows the number and kind of operations performed. The boring tool is in working position, being followed by a recessing tool in an offset bar, and this in turn by the undercutting, circular-form tool on the end of the taper shank at the upper left. Then comes the reamer, bolted to the fact of the turret, and finally the finishing reamer, counterboring and facing tools in the last turret station.

Both ends of the cross-valve chamber are milled at the same time on a double-head Cincinnati milling machine, as in Fig. 3. It will be noted that there is a separate table on top of the regular table of the milling machine. On each end of the upper table is a sort of centering fork, as at *A*, this fork fitting the rounded end of the cylinder head and centering it by the curved contour. With the centering fork in position at each end and clamped by the screws shown, the work is then fastened to the milling machine table by means of L-shaped straps. Under each centering fork is a long, square cold chisel, the end being shown at *B*. The operator strikes each chisel with a hammer and makes a vertical mark on the edge of the casting as a locating point for the next operation.

These locating points enable the operator on the horizontal boring machine shown in Fig. 4 to accurately set the cylinder-head casting by the center mark shown, and so insure that the hole bored will be square with the ends previously milled. It will be noted that the plate on which the casting rests is separate from the circular table, but that it is positioned accurately by means of the plug *A* together with suitable stops and clamps.

Between the steam and air cylinders of the pump is



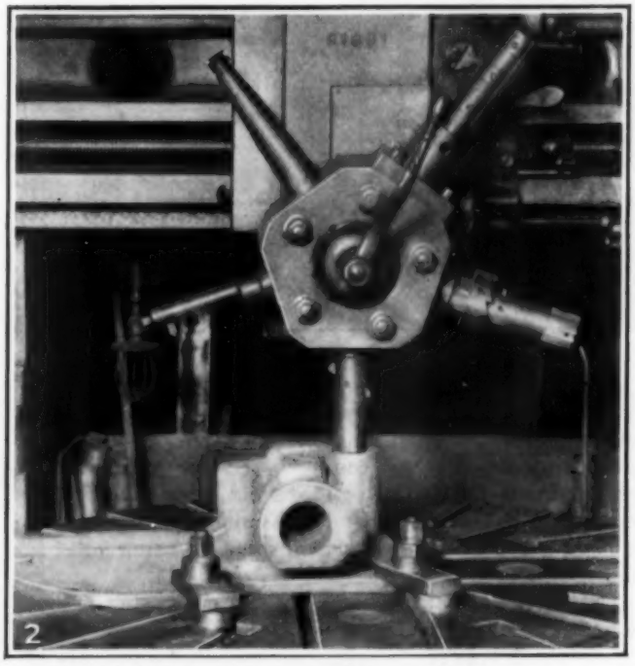
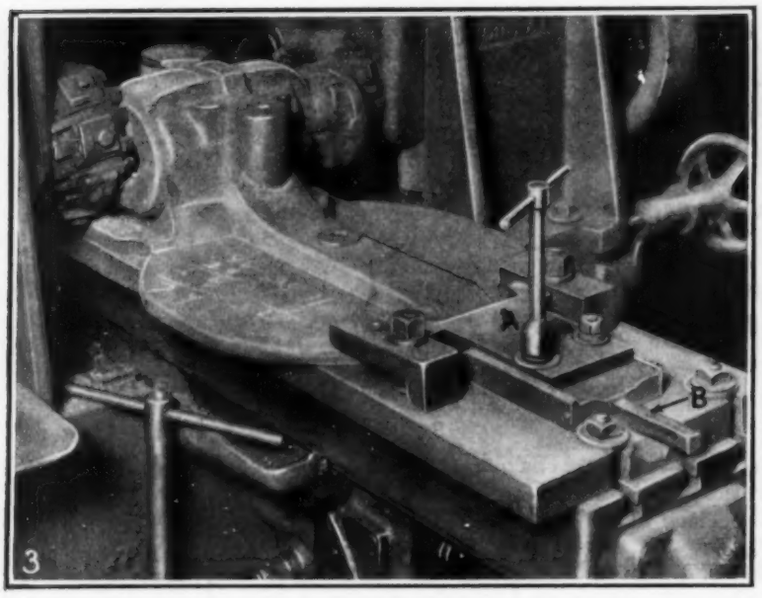


Fig. 1—Facing bottom of cylinder head. Fig. 2—Machining for the controlling mechanism



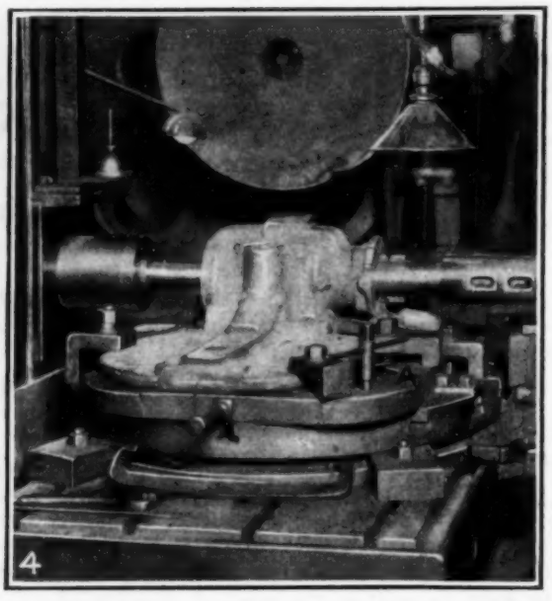


Fig. 3—Milling the ends and centering. Fig. 4—Boring the cross-valve hole

a center piece through which the piston rods run and in which are the stuffing boxes that are packed to prevent leakage around the rods. This piece is surfaced on each side in the usual manner, after which the piston-rod holes are bored and the stuffing boxes counterbored, faced and tapped as in Fig. 5. The head is clamped against the heavy angle plate *A* which is provided with an extension for guiding the boring bars.

After boring, the bosses around the rods are faced

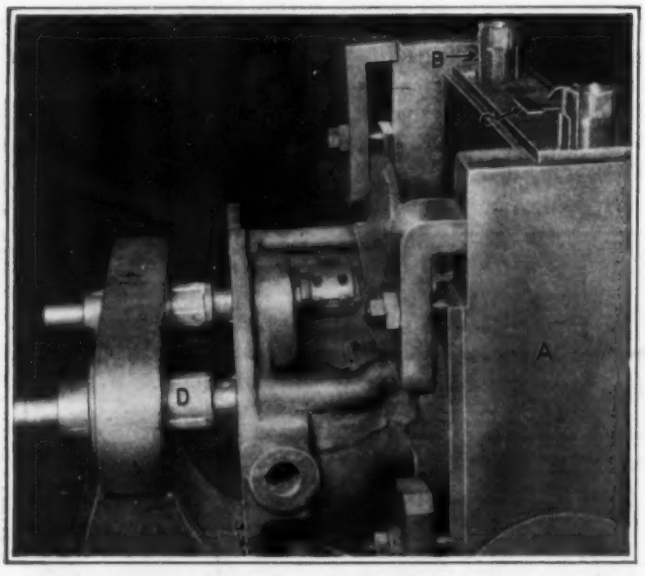


Fig. 5—Boring and tapping packing boxes

by the cutters shown in position. Then the combined counterbores and taps, as at *B* are placed on the rods and the stuffing boxes counterbored for the packing and threaded for the nuts that hold it in place. The depth gage is seen at *C* and the guides *D* are unusual in having four bearing strips instead of being solid at the full diameter.

There are, of course, many other interesting operations in the manufacture of air pumps for railway work. All of the various parts have some operations that are of special interest because of fixtures and tools that have been developed to secure the desired accuracy and at the same time reduce costs and utilize the available equipment. But the operations shown give a general idea of both the equipment and the methods used, and explain how some of the many problems have been solved.

Most of the methods shown can be adapted for use in other lines of work and should prove helpful in handling some of the unusual work that comes along from time to time. And it is the ability to adapt and utilize ideas that helps men in any line.

Group Insurance in Industry

The growth of group insurance in American industry, which had its real beginning in 1912, has been so rapid that at the present time approximately 3,000,000 workers are covered under this form of insurance, many of whom before were in no other way protected, according to a study made by the National Industrial Conference Board. An investigation leading up to the inception of the group insurance plan in 1912 revealed at that time that the great majority of wage earners carried no life insurance of any kind, and that the majority of those who were carrying life insurance were insufficiently protected.

Under the group insurance system, workers can carry insurance additional to what they could carry individually, and in cases where occupational hazard, advanced age or physical defects would make them unacceptable risks, can still obtain the protection they need, as under the group plan no physical examination is required. Group insurance, considerably cheaper than individual insurance, is sometimes paid for by the employer, sometimes by the employee, and sometimes by both contributing to the cost.

The growth of group insurance as reflected in the amount of insurance in force is impressive. In 1912, the amount of group insurance was $13,172,198; in 1917, it had risen to $346,525,472, an increase of 2,630 per cent; in 1922 it was $1,852,593,553, an increase of about 14,000 per cent in the twelve years. Last year, in one company alone there were 540,000 lives covered by group insurance.

Six Opinions on Dimensioning Drawings

The ideas of six men answering an article that requested suggestions to help the Ordnance Department in its desire to produce workable working drawings

Questioning the Ordnance Drawing

By J. A. Long

THE problem of dimensioning a drawing so it can be universally understood and worked to is basically dependent on discovering, writing down and meeting the difficulties presented in actual practice.

By placing myself in the position of the man who is to work to the Ordnance Department's drawing, originally published on page 643, Vol. 62 of the *American Machinist* and reproduced in Fig. 1, I find a number of questions which I would have to ask before I could proceed with assurance of being correct. I am asking them in the order that they occur to me, as representing an average engineer, feeling that they can form a basis of discussion and the start toward solving the present difficulty. Attempting to answer these questions may uncover a number of solutions.

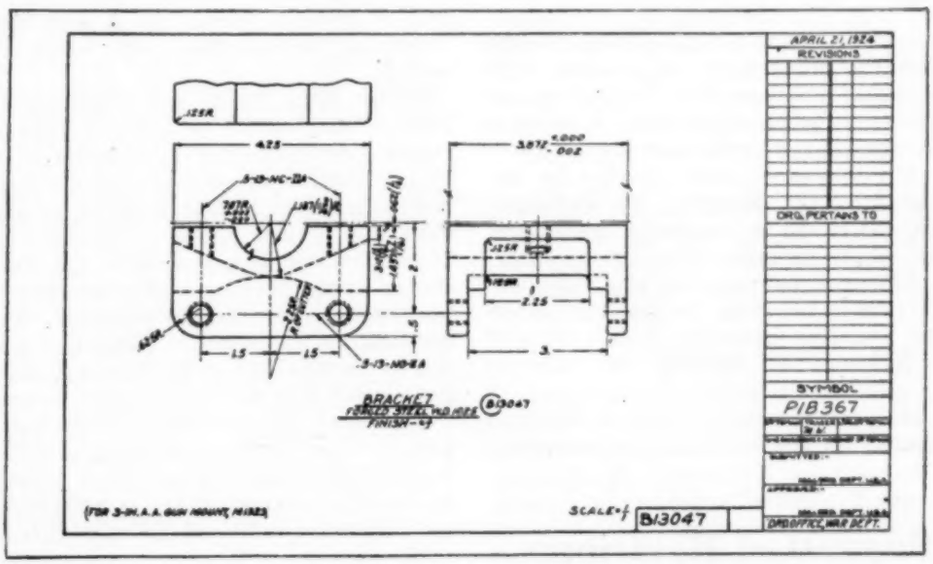


Fig. 1—Ordnance Department method of dimensioning drawings

Why put an *f* on a dimension line?

What is .5-13-NC-IIA? Why the decimal, .5?

Why not move the two bottom views down so that the top view can be completed?

What is the tolerance on dimensions where tolerances are not expressed?

The use of symbols, initials and abbreviations are not proper, to my mind, unless the meaning is self-evident or an explanation given. Where is the explanation?

What is "finish-cf?"

For convenience of filing, what is the drawing number?

There is a line from the lower .5-13-NC-IIA to a dimension line. Does this refer to the hole?

Should not the NC-IIA be changed to NC-2 (see N. S. T. C. revised report No. 61)?

For the purpose of estimating, how many brackets are to be made?

Should not the 2.25-radius section be marked with an *f*?

What is the *f* for between the .312 and 1.437 dimension?

Are all the dimensions in inches?

Are the ends of the top view, not shown, rounded with a .125 radius? If not, what is the shape of the far end?

What is "forged steel WD1025"?

What is B13047?

Is the dot-and-dash line .062, above the two views, a facing line? If so, should not a facing line be shown on the sides of the right-hand view? Why is there a .125 radius in the right-hand view at the intersection of the 1.187 and 2.25 radii?

Should not a tolerance be placed on the 3 opening where cut by a mill?

Should not an *f* be shown on the sides of this opening to indicate a machining operation?

Should not a tolerance be given for the dimension locating the tapped hole?

Are the parts where tolerance is indicated to be gaged with "go" and "no-go" gages?

Are "go" and "no-go" gages to be used in tapped holes?

How should the piece be treated after machining, painted, pickled, sand-blasted or oiled?

Should the product receive any identification marking?

It is an easy matter to comment and criticise the work of a draftsman, but it is difficult to execute a perfect drawing.

There are many varying ways of showing the same thing in different localities that the present discussion may clear up but the same variation existing within each given organization must not be neglected for it is just as important in the final reckoning.

* * * *

Uniformity in Expressing Decimals

By E. L. Rudebock

I NOTICE as one point in the question that many dimensions, while indicated in decimals, are shortened as much as possible, for example 4.25. This is probably all right in a shop that is accustomed to it, but as most mechanics work to "thousandths," it would seem better to express all decimal dimensions with three figures, as 4.250. Adding a fourth place, when necessary, would seldom cause trouble because most mechanics, capable of reading and working to thousandths, are able to recognize "tenths." This point comes to my mind in that I have actually seen serious errors made by a competent mechanic having read 4.25 as four and twenty-five thousandths. If the figure had been written 4.250, he would never have made such an error. Several such instances have come to my attention, and I am sure to many others.

* * * *

Standardize the Instructions

By T. F. Githens

Mechanical Engineer, The Cleveland Twist Drill Co.

I BELIEVE the instructions regarding dimensions and tolerances which the department has adopted, with the revisions published on page 644, Vol. 62 of the *American Machinist*, to be good practice. I think it would be a step forward if standard instructions regarding dimensions and tolerances were adopted by the A.S.M.E. and the A.E.S.C. Many of the Ordinance Department's methods might be included to advantage.

With reference to the example given for an interference fit, the difference between the maximum and minimum interference is too great for practical interchangeability and selective assembly should be used with the same tolerance on internal and external members.

Selected (desired) interference, 0.0015, is obtained by mating large external and large internal members, or vice versa.

* * * *

Three Suggested Revisions

By John Homewood

IT IS gratifying to know that the *American Machinist* is endeavoring to correct the variety of opinion existing between manufacturers and the Ordnance Department as pertains to dimensioning and reading drawings. If we were to take three men from the engineering field and submit to them a question on dimensioning methods, the chances are that we would get two definite replies and one that would be indefinite, "Yes," "no" and "I'm on the fence." It is the purpose of this discussion to help eliminate the fence and to obtain harmony between the other two.

There was a time when the department was considered as something entirely apart from manufacturing; in fact, as far as manufacturers were concerned, the word, ordnance, did not exist. Since the War, this idea has changed. It has been proved conclusively that the Ordnance Department is just as much a part of our system of manufacturing as the thousands of manufacturing establishments are the most vital part of our system of defense.

The Ordnance Department having adopted the use of decimals and the manufacturers using the vulgar fractions, presents a problem none too easy to solve. The writer is of the opinion that the use of decimals, as now practiced, is carrying things too far. The average mechanic would question such a dimension as 0.125 *R*.

The question arises, "Is it necessary for that radius to be so accurate?" The trouble is in the psychological effect upon the reader.

We have no other instrument with which to measure a radius of ⅛ in. than a scale or gage, while we have micrometers and verniers for measuring 0.125 in. Even when a limit of 0.005 in. either way is understood by the workman, there is the disadvantage of having him convert the decimal to a vulgar fraction in order to set his dividers from the scale. The system of using decimals creates too many eddy currents that retard definite thought. If the Ordnance Department continues to use decimals in the place of fractions, the following rule should be on the blueprint where it can be seen:

"All dimensions given in decimals are limited to a variation of about 0.005 in., plus or minus, unless otherwise noted." If this brings up a question as to just what "about" means, fire the questioner for his lack of common sense. As it now stands, who is to determine the exactness with which a person should work?

Where 16ths, 32nds and 64ths are used, the three-place decimal should be followed in parenthesis by the vulgar fraction that it is intended to represent. The vulgar fraction would serve for the convenience of the workman whose mental worshop is too crowded with essentials to use it for a decimal equivalent chart. If the fraction is placed there for that purpose, why clutter up the drawing with unnecessary decimals when the fraction answers the purpose? For ordinary understanding, the decimal point is a mark of caution, and where it is used on the drawing, indicates a working limit closer than can conveniently be made with a scale.

This does not necessarily mean that a man cannot work to close limits when using a well-made scale. It is no mark of exceptional ability to stay within 0.005 in., plus or minus, which is sufficiently accurate for such things as radii and distances that are not unnecessarily limited.

Referring to the sample drawing, Fig. 1, the side view (to the right) has on it two .125-*R* dimensions. Even were these dimensions shown in vulgar fractions, there would be sufficient reason to criticize their placing in the positions shown, as one is elliptical and not radial, and the other, while it would be correct if metal were there, does not exist, owing to the metal being cut away by the 2.225-*R* cutter.

The fact that these two radii were placed in decimal dimensions makes such a practice seem ridiculous. The radius intended cannot be correctly shown unless an auxiliary view or a section is given.

The conclusion, from the writer's viewpoint, is that vulgar fractions should be retained, and, of course, placed in the correct position to represent what they are intended to.

The writer is in accord with the system of limits. The advantages of the unilateral system of dimensioning over those of the bilateral system have been very widely discussed in former issues of the *American*

Machinist. Could we not simplify matters considerably in this system (unilateral) by eliminating the no-limit sign or figures? Instead of the dimension 3.872, greater neatness would obtain if the 0.000 limiting figure were eliminated entirely and the limiting figure, 0.002 placed after the main figure, inclosing the latter in brackets thus: 3.872 (—0.002). This would result in greater neatness on the drawing without jeopardizing the intent of its meaning, understanding, of course, that the main figure would be the other limit.

The writer suggests that the Ordnance Department adopt the following revision to its system of dimensioning:

Dimensions placed in vulgar fractions to be within limits of about five thousandths of an inch, plus or minus.

Dimensions which are placed in decimal fractions and followed by the limit, plus or minus, in brackets, to be taken as the other limit, minus or plus, as the case may be.

No decimal dimension to be given unless accompanied by limits pertaining thereto.

* * * *

Dimensioning the Piece

By John Mark May

VULGAR fractions have, in years past, served a good purpose. At the present time micrometers and the practice of reading and talking in thousandths are in such general use, it would seem that the Ordnance Department is justified in the belief that the vulgar fractions can be dispensed with.

The accompanying drawing of the bracket, Fig. 2, shows how I would dimension the piece. The additional information from the centerlines, both ways, shows that

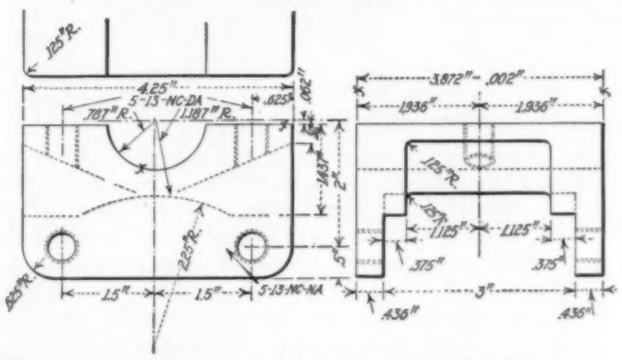


Fig. 2—A suggested method of showing the dimensions

this line is exactly central. This is a line that could be assumed to be central or regarded as a place where a liberal allowance would be tolerated.

It will be noticed that where there is no tolerance shown, the ciphers are omitted, as they appear to the writer to be superfluous.

I assume that a specification sheet would accompany the drawing, stating allowances on places where no finish marks appear.

In certain engineering departments a single dimension across a piece, as in the case of the Ordnance Department drawing, indicates a uniform location about the center. In other places this is not so and I believe in dimensioning so nothing is left to the imagination, or to interpretations that may vary.

* * * *

A Proven System

By Harvey S. Pardee

Miller & Pardee, Engineers, Chicago, Ill.

THE drawing, Fig. 3, illustrates my ideas of the correct way to dimension drawings. The points included are the result of actual experience in dealing with shops.

First, the notation used to specify the tolerance limits has the advantage of avoiding much congestion on the drawings over the usual method as illustrated in the drawing originally published, Fig. 1. It was tried out in our shops, being introduced without any explanation to the workmen. No confusion, or even comment, resulted. You will note that plus limits are written over the dimension and negative limits underneath. Inasmuch as one-way tolerances are the rule, there should be no need of indicating positive or negative zero tolerances on the drawings.

Every dimension on the drawing is given a tolerance limit. Where the limit is not indicated on the drawing, it is covered by the clause "Allowable variation on fractional dimensions ( ) plus or minus. On decimal dimensions plus or minus ( ) unless otherwise noted."

This general clause saves a large amount of space on the drawings and a great deal of useless figures and checking. My experience has shown that waste of labor, or of material, and argument arise from diversified interpretation of dimensions given without tolerances, especially when the part is not named on the drawing and the workman has no means of judging the importance of precision.

He may waste labor in making the work too close or, depending upon his mood, may take undue liberties with the nominal dimensions. I have found on drawings, such as the one herewith submitted, that the tolerances specified in the general clause are used about as frequently as those indicated on the dimension line of the drawing.

Decimals versus Fractions

Regarding Rule 31 of the Drafting Room Regulations of the Ordnance Department, I do not approve of the use of decimals where fractions are intended. Between the mind of the designer and the finished product there are two intermediate stages of dimensioning. The first is the figures indicated on a drawing, the second is the setting of a measuring instrument or tool in accordance with the figures. These two stages should mutually adapt themselves.

In American shop practice there are two distinct classes of measuring devices. One class embraces the ordinary scale, divided into fractions of an inch, together with dividers and calipers which limit the precision to about $\frac{1}{64}$ in., one way.

The other class includes the micrometer, the machine-tool index, the vernier caliper, the precision gage block and other devices with any desired range of accuracy. The former is, by far, the most used.

Any competent designer will, in nearly every case, know which of these classes of tools will be used to transfer a dimension in the shop. In fact, if there is good co-ordination between the drafting room and the shop, the shopman will naturally pick up a scale when he sees a fractional dimension and a micrometer or other decimal-reading instrument when he sees a decimal dimension.

is this not a sensible way for two minds to co-operate? Then why annoy an otherwise happy workman by giving him a decimal dimension when he is expected to use an instrument reading in fractions?

There is friction enough between engineering departments and the shops as it is, and when a workman is given a drawing which departs from common usage he likes to spend his time and temper in kicking about it.

It appears to me to be objectionable to indicate both decimal and corresponding fractions on a drawing. It introduces another opportunity for mistake by the draftsman and also by the mechanic. It is bad policy, in my opinion, to indicate on a drawing more than one way by which a given dimension may be obtained. It clutters up the drawing and certainly openness and clearness are important points of merit.

As a point of interest, I suggest that my drawing be traced with the dimensions placed in accordance with the rules of the Ordnance Department. The relative clearness of the two methods will then be apparent. I venture to say that a dimension, such as 0.062 ($\frac{1}{16}$), will be confusing to any mechanic who has not had its meaning explained to him.

In the first place, its greatest fault is that it is "queer." Even if it could be logically explained, it is not sanctioned by general usage. A mechanic, who sees it for the first time on a drawing, is confused as to the precision required and the kind of tool he is to use, and then he sees that the decimal and the fraction do not agree. Of course, if "rule 31" is shown him, he will understand that the decimal is put on because of the rule and that he is to ignore it and use the fraction instead.

The Ordnance Department is to be congratulated on its policy of seeking information as to commercial practice in connection with its engineering policies. If its drawings and specifications speak the language of the average every-day workman or contractor, a bond of mutual sympathy and understanding is thereby created. In the past there has been a tendency to pass up the queer and arbitrary notions voiced by various government departments with mixed feelings of pity and hopelessness.

In my opinion, not only the War Department, but industry in general would benefit if the department should take an intelligent lead in such matters as standardized dimensioning. By taking the lead, however, is not meant installing innovations. It is the same in the case of language. The standards of good usage are set by the best writers and the best speakers. But as soon as one of them departs even a short distance from the generally accepted usage, he losses his leadership.

I think it would be inspiring and helpful were the Ordnance Department to take advantage of what authority it has, and by a thoughtful and conservative policy avoid arbitrary rules of its own and select and adopt only the best of practices in general use with which the ordinary citizen is familiar and to which he has taken a liking.

This action in itself would, when properly advertised and understood, engender a feeling of confidence and partnership between the public and the department.

A great many of the misunderstandings which have occurred in the past have been due, aside from actual omissions, to the attitude of the man who is to read the drawing. If he holds a feeling of confidence at least half of the questions that come up in meeting the drawing intent are solved. On the other hand let any man pick up the handicraft of another in a spirit of criticism and the result can be set down as a foregone conclusion no matter how carefully the work has been executed or how many specifications are given.

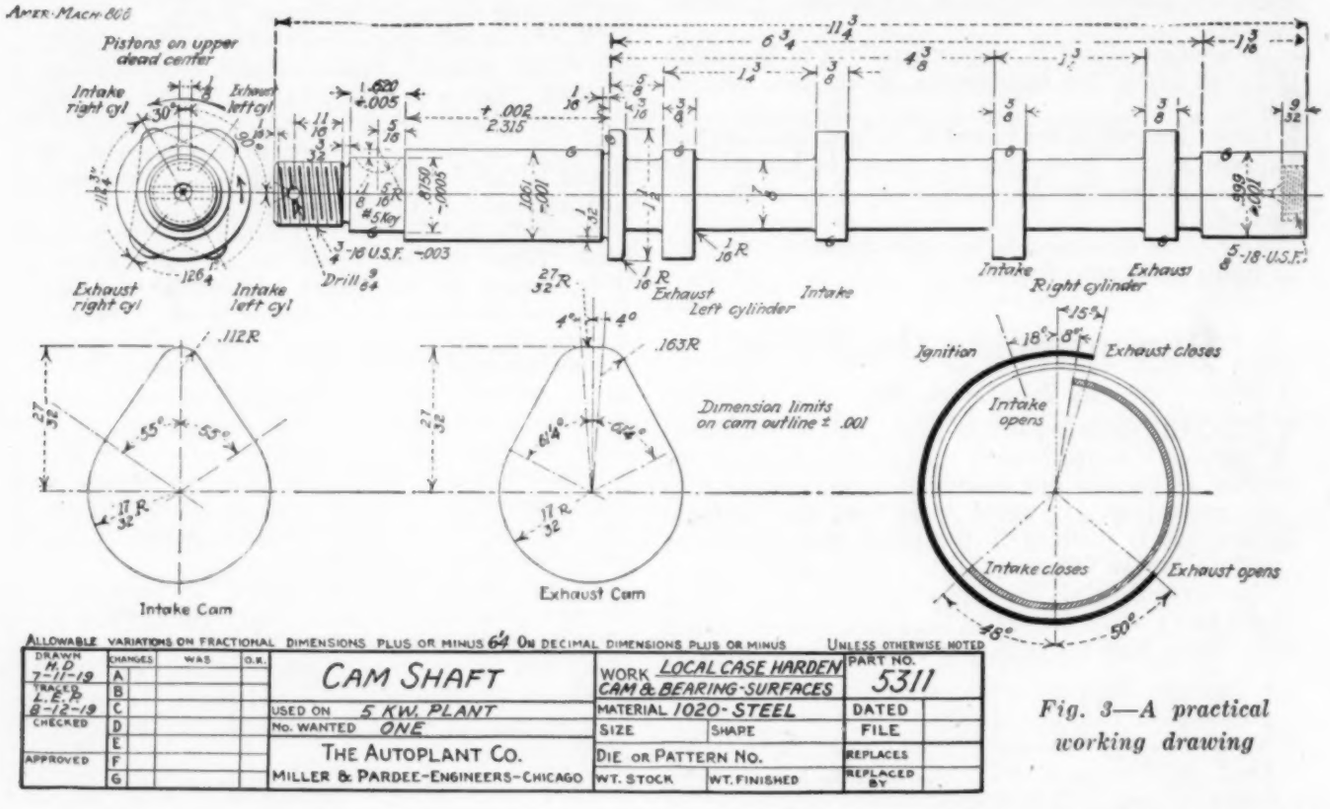


Fig. 3—A practical working drawing

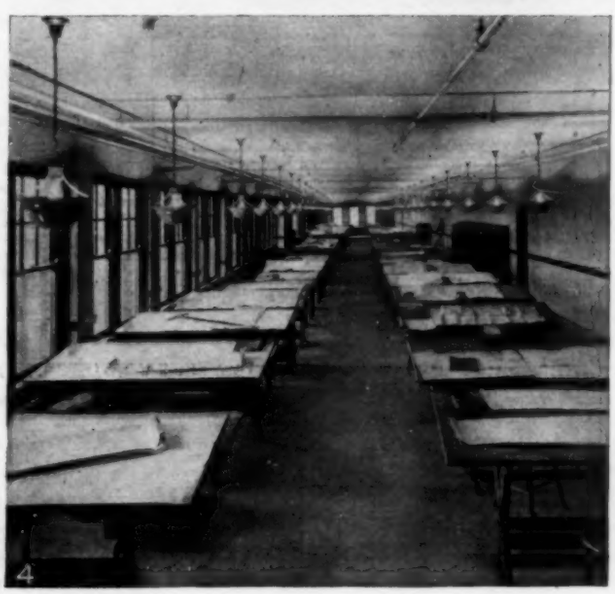
Modern Drafting Rooms

1 and 2—R. K. LeBlond Machine Tool Co., Cincinnati. Capacity, 35 to 40 men. Inverted lighting—300-watt lamps.

3—Fellows Gear Shaper Co., Springfield, Vt. Cutter, fixture and outfit department—with two others, occupies 4,000 sq.ft.—15 men. Indirect lighting, 10x8-ft. centers—300-watt lamps.

4—Foote-Burt Co., Cleveland. Room 214 ft. long with 46x20-ft. L at end for engineering files and blueprints. Capacity, 100 men. Inverted lighting—300-watt lamps.

5—Same room taken at night. Illuminating system only, used in taking photograph.



Making a Steering Gear for Low-Pressure-Tired Wheels

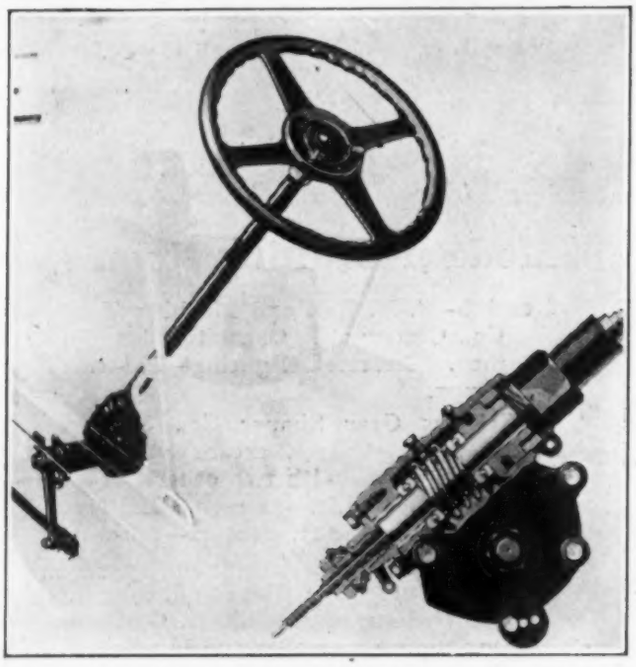


Fig. 1—Parts of the Packard steering layout

Some of the manufacturing refinements employed by the Packard Motor Car Co. to insure safety and easy steering with low-pressure tires

By John Younger
Associate Editor, *American Machinist*

WHEN the public accepted balloon tires as desirable equipment for its automobile it found their use not always an unmixed blessing. With low pressure tires came "wheel shimmy" and the demand for greater effort at the steering wheel, with many steering gears which lacked the proper leverage or ease of action to adapt themselves to "balloons."

Of the two, wheel shimmy is the more serious for, unless tire pressures are kept up to a point where they practically nullify the easier riding qualities of the low pressure tires, "shimmy" is certain to occur and it can grow to the point where it is a real danger. In fact if anyone with an old model car is thinking of using balloon tires he should be warned never to let his tire pressure fall below 35 pounds or else drive only at

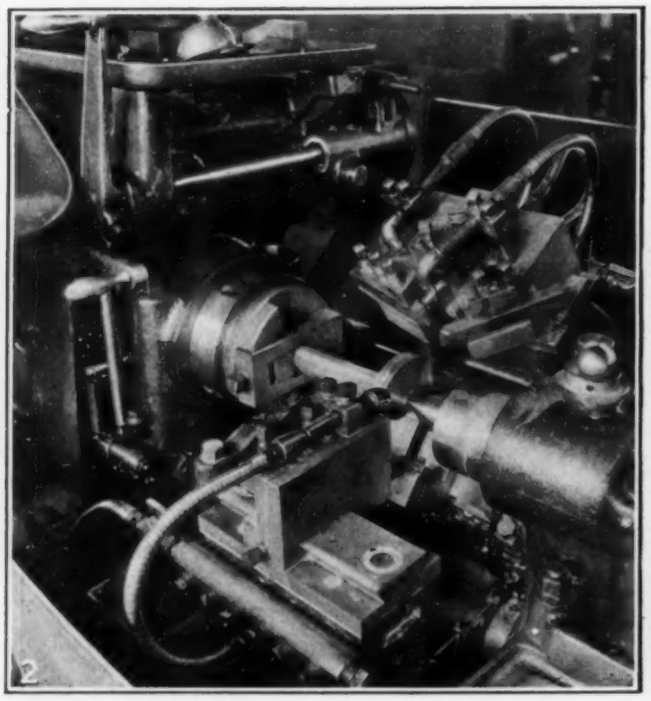


Fig. 2—Set up for machining the worm gear sector

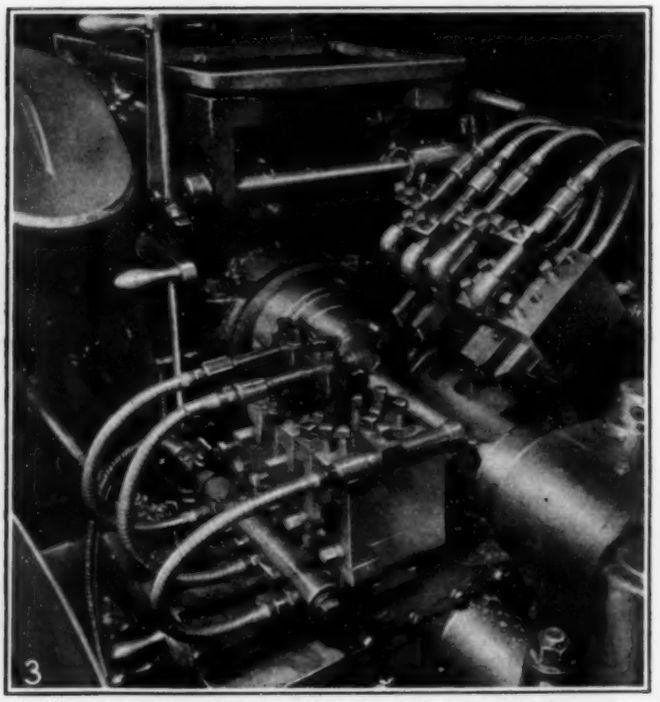


Fig. 3—Turning the sector shaft

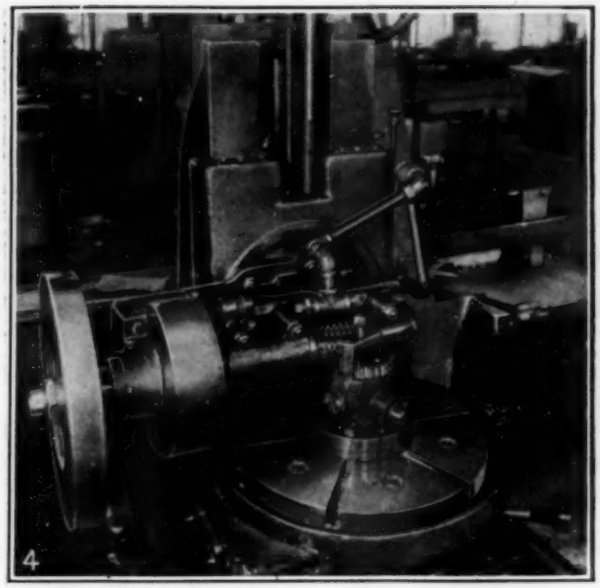


Fig. 4—Hobbing the sector teeth

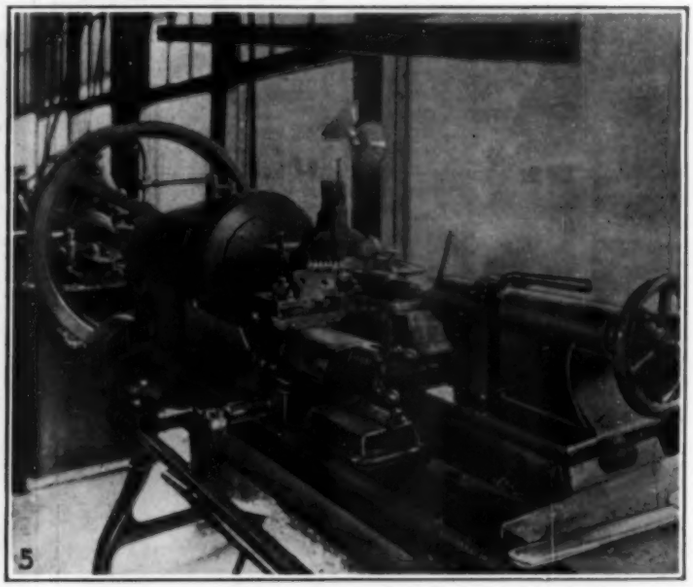


Fig. 5—Chasing the worm thread in a modified lathe

the most moderate speed. He must expect also to exert greater effort on the steering wheel in guiding his car.

Before adopting low pressure tires as standard equipment on all its cars the Packard Motor Car company made some exhaustive tests as the result of which it was found the whole steering mechanism would have to be designed to meet the problems presented by the new tires. There had to be an entire change in the steering geometry to solve the problem of "wheel shimmy" and a new steering gear was designed to give ease of action. How some of the steering parts are manufactured in the Packard factory is outlined in what follows.

The steering gear layout is shown in Fig. 1. As will be seen the essential mechanical feature is the sector of a wormwheel meshing with a worm. The sector is integral with its shaft and is a drop forging of alloy steel. After the sector shaft has been centered, the circumference of the sector is turned and the sides are faced in the Fay lathe shown in Fig. 2. A second Fay lathe, Fig. 3, turns the body of the shaft to the required contour. The arc is then hobbed as shown in the Gould & Eberhardt machine, Fig. 4, thus completing the main machining operations on this piece.

The worm is finished in an unusual way. The threads are roughed out in a Fellows thread generator and are then turned on a lathe rigged up as in Fig. 5. The tool used is in the nature of a thread chasing tool, and has the same progressive characteristics, each cutting edge taking off a little more than the preceding one. The tool is shown on top of the cross-slide in the illustration. Note the slow speed driving pulley on the lathe. The saddle is geared to the lead screw so that no error is possible in registering the tool with the threads.

After heat treatment, the worm is mounted on a speed lathe spindle and is geared to a buffing wheel as shown in Fig. 6. This wheel is built up of strips of asbestos brake lining material placed radially around the circumference. A fine grade of carborundum is used for the polishing material.

The worm and sector are then mounted in the various testing devices shown in Fig. 7. It will be noted that in addition to the proper mesh being checked, other properties are also tested.

The housing for the gears is worth noting in passing. It is a malleable iron casting and is first chucked as shown in Fig. 8 in a Potter & Johnston machine for

Fig. 6—Polishing the worm threads

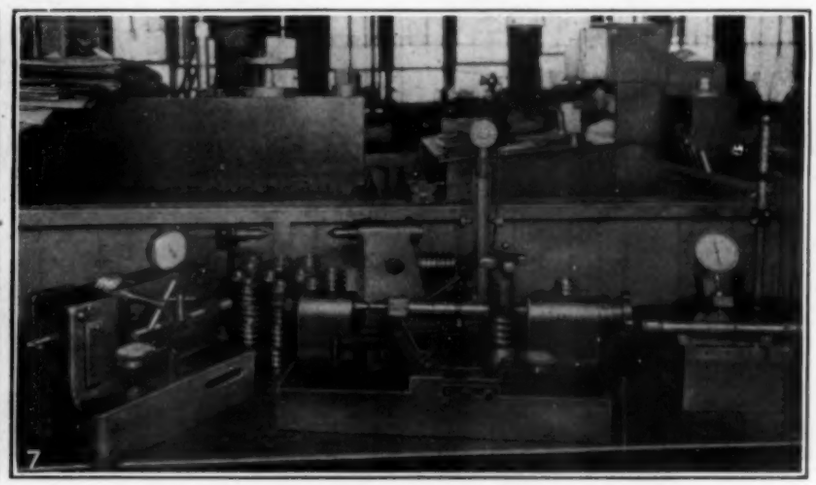


Fig. 7—Inspection fixtures for worm and sector

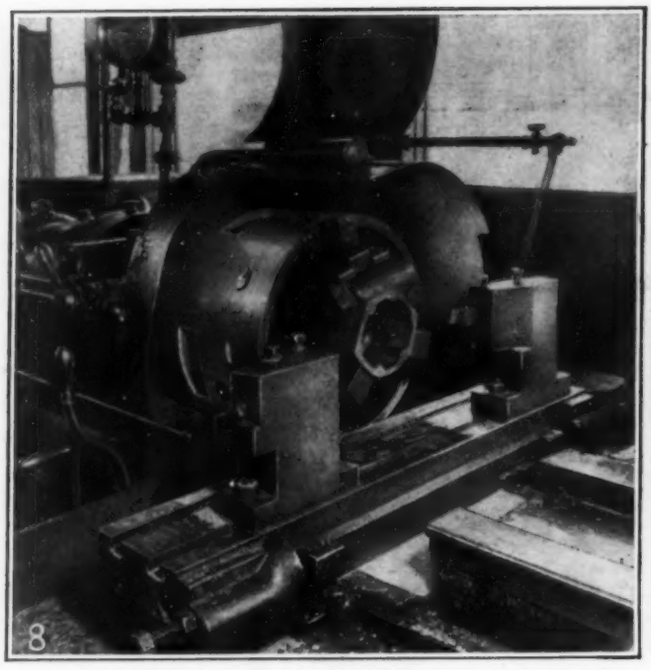


Fig. 8—Boring and facing the gear case

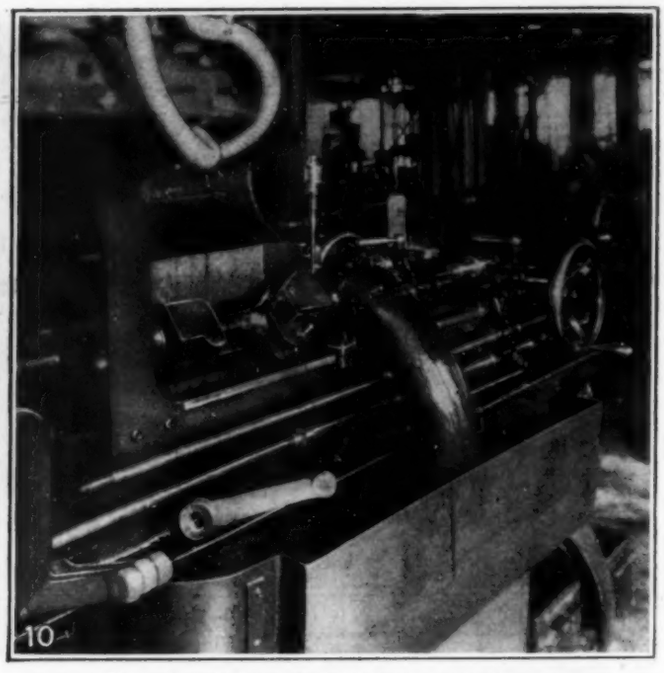


Fig. 10—Drilling oil hole in steering arm

boring and facing. Fig. 9 shows a Brown & Sharpe milling machine at work on the flange. This picture gives a good illustration of the type of jig used in this work. It will be evident from the illustrations that standard machines are used for manufacturing as far as possible.

An unusual operation is shown in Fig. 10. It consists of drilling out the steering arm with a gun drilling machine. The Packard company uses an automatic lubrication system that oils all parts of the chassis including the steering gear. Oil is conducted through the small hole in the steering arm to the ball joint at the rear of the drag line. Much trouble was experienced at first with gun drills breaking in the high-tensile, tempered alloy steel used for the steering arms. It was found that most of the breaks were due to irregularities at the weld of the drill bit to the stem, so now the drill is backed off behind the point and is carefully smoothed at the joint. This slight improvement has virtually eliminated the trouble.

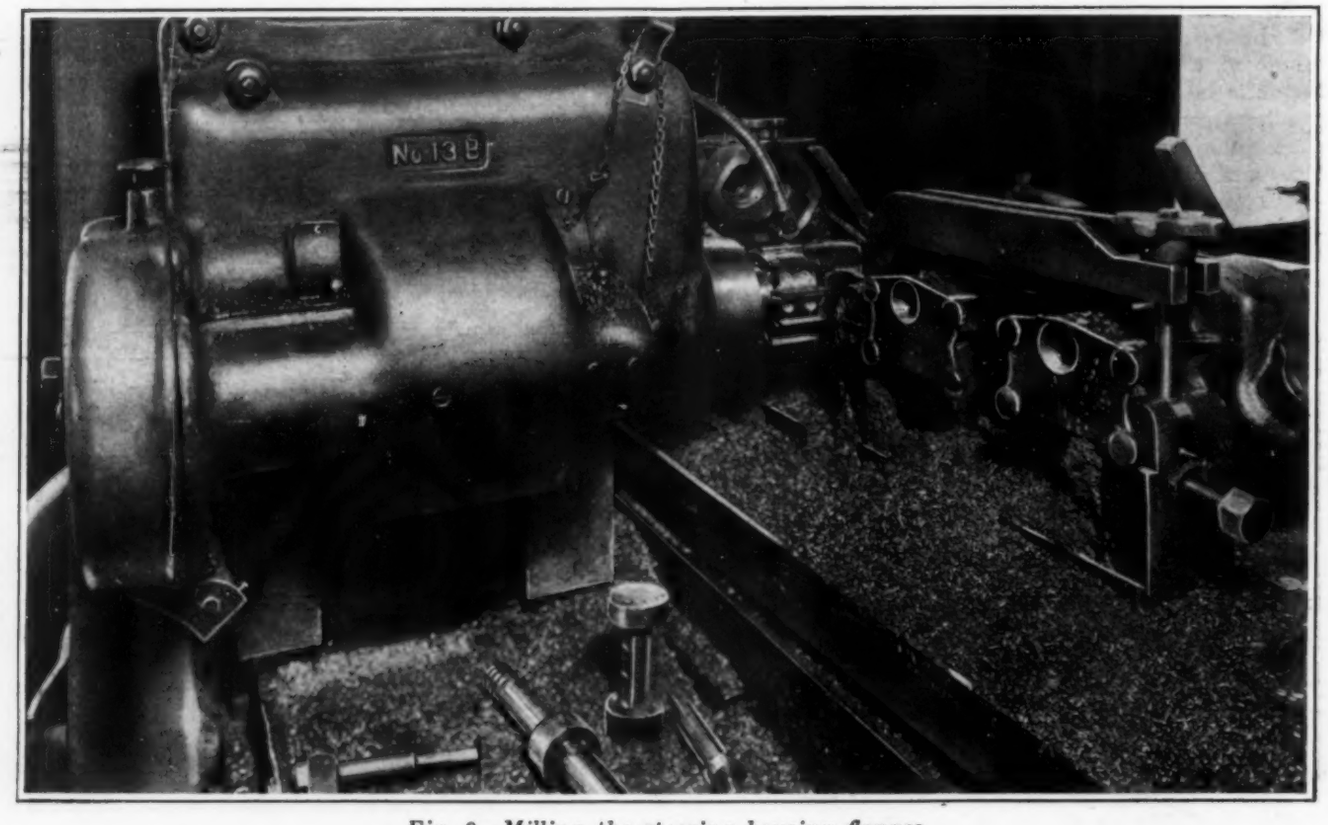


Fig. 9—Milling the steering housing flanges

Establishing Manufacturing Tolerances of Gearing

By Harry Hoisington
Ordnance Engineer, Rock Island Arsenal

Using feelers for testing backlash of gears — Master rack for testing spur gears in place of a master gear—Suggested tolerances for spur gears and close-fitting worm gearing

THE establishing of tolerances in gearing is a subject that has been more or less avoided by production engineers for several reasons, among which may be the lack of established practice in regard to the methods of measurement. The common practice of testing gearing appears to be that of mounting the gear in a fixture, having a correct theoretical center distance, and revolving it in mesh with a master gear, the inspector insisting that there is no binding between the two gears and depending on his judgment as to how much looseness can be allowed. If the shafts on which the gears run are not too close together, the gears give fair satisfaction in service, therefore, the theoretical center distances are, in some cases, slightly increased "to be on the safe side."

More recent practice provides for a certain clearance between gear teeth to compensate for unavoidable eccentricity in the gears and incorrect spacing of the teeth due to the usual inaccuracies of gear-cutting mechanisms. Tables have been published mentioning a desired backlash, one-half of which is to be secured in each gear by setting the cutter, forming the tooth space, farther into the gear. The objects of the information given here are to analyze this practice more closely to see if practical limits cannot be set for the amount of looseness, and to suggest methods of testing and of indicating on gear drawings more exactly what the gear-cutter operator is to do.

The consensus of opinion of a number of engineers, connected with gear-cutting firms, indicates that tolerances on gears may be better expressed in terms of backlash; for form gearing the backlash may be tested and measured in terms of the angular movement of the wormshaft; for external-spur gears and racks in terms of backlash, measured by the amount that the theoretical distance may be reduced when the gear to be measured is in mesh with a correct master gear or rack. For bevel gearing so many variables enter as to force the conclusion that, for accurate work, a separate fixture with master "go" and "no go" complementary gears should be provided for each pair. Among the suggested methods for measuring backlash is the use of thickness gages. A glance of Table I, for example, shows that such thickness gages must be thin and that their flexibility will seriously interfere with their use, also that constant replacements would be necessary. Since there are so many difficulties in securing an exact master-bevel gear, it is probable that thickness gages, or feelers, should be generally resorted to as "no go" gages for testing bevel gears.

The limitations of some accurate gear-producing machines are more than many people imagine. It is advisable to determine what the closest possible work on a production basis is like. In considering the clearances and other points involved it must be remembered that absolute concentricity of gears is rarely found, and any machine depending on an index mechanism, for the spacing of gear teeth, will be found to have errors

Table I—Proposed Tolerances for Spur Gears and Supports

20 deg. involute, closest practical work on production basis, presupposing high speed, hardened and ground gears or accurately cut gears

Diameter Pitch	Running Clearance Expressed as Backlash	Allowable Variation in Each Gear	Maximum Amount Each Tooth Space is Widened Including Half Clearance	Necessary Allowed variation in Center Distance	Backlash Resulting from Maximum Center Distance	Greatest Allowable Backlash in Pair, Assembled	Allowable Variation from Theoretical Center Distance of One Gear and Correct Master Rack
2	0.004	+0.0025	+0.0045	+0.003	0.0022	0.012	—0.0027 to —0.0061
2.5	.004	.0025	.0045	.00275	.0020	.011	.0027 to .0061
3	.003	.0025	.004	.00275	.0020	.010	.0021 to .0055
3.5	.0025	.00235	.0036	.0025	.0018	.009	.0017 to .005
4	.002	.0022	.0032	.0025	.0018	.008	.0014 to .0044
5	.002	.0016	.0026	.0025	.0018	.007	.0014 to .0036
6	.0015	.0015	.00225	.0025	.0018	.0065	.001 to .0031
7	.0015	.0015	.00225	.002	.0015	.006	.001 to .0031
8	.001	.0015	.002	.002	.0015	.0055	.0007 to .0027
9	.001	.0015	.002	.0015	.0011	.005	.0007 to .0027
10	.0008	.0015	.0019	.001	.0007	.0045	.0005 to .0026
12	.0008	.001	.0014	.001	.0007	.004	.0005 to .002
14–18	.0006	.001	.0013	.001	.0007	.0033	..... .0015
20	.0004	.001	.0012	.001	.0006	.003	..... .0015

Table II—Proposed Tolerances for Spur Gears and Supports

20-deg. involute, ordinary conditions with cut gears — not hardened. Good center distance fixtures. Assembling without fitting or selection. Suitable for gun-carriage elevating and traversing-gear trains.

Diameter Pitch	Running Clearance Expressed as Backlash. In Pair	Allowable Variation in Width of Space. Either Gear	Maximum Amount Each Tooth Space is Widened, including Clearance in Column 2	Necessary Allowed Variation in Center Distance of Shaft	Backlash Resulting from Maximum Center Distance	Greatest Resulting Backlash in Pair, Assembled	Allowable Variation from Theoretical Center Distance of One Gear and Correct Master Rack
2	0.010	0.0028	+0.0078	+0.007	0.0051	0.021	—0.0069 to —0.0107
2.5	.0075	.0025	.0063	.0065	.0047	.017	.0052 to .0087
3	.0054	.0025	.0052	.006	.0044	.015	.0037 to .0071
3.5	.004	.0025	.0045	.005	.0036	.014	.0027 to .0062
4	.0028	.0025	.0039	.0034	.0029	.011	.0019 to .0054
5	.0026	.0025	.0038	.003	.0022	.010	.0018 to .0052
6	.002	.0021	.0031	.0025	.0018	.008	.0014 to .0043
7	.0017	.0019	.0027	.0025	.0018	.0072	.0012 to .0037
8	.0012	.0018	.0024	.002	.0015	.0063	.0008 to .0033
9	.0008	.0017	.0021	.002	.0015	.0057	.0005 to .0029
10	.0008	.0015	.0019	.0015	.0011	.0049	.0005 to .0026
12	.0008	.0012	.0016	.001	.0007	.0039	.0005 to .0022

[however small] in the spacing. For these reasons it is necessary to provide working clearance between the teeth. There is more difficulty in maintaining exact center distances and parallelism of shafts in the frame that is to support the gears than many engineers allow for. Table I shows my conception of the closest possible work on a production basis for spur gearing. It is intended that a master rack should be used in testing the gears rather than a master spur gear, for two reasons; one being that the actual backlash between a pair of mating gears may not be quite the sum of the backlash measured by each gear separately with a rack, yet the rack may be a standard for all gears and the slight differences will be largely theoretical.

The second reason for the use of the rack lies in the accuracy with which the master racks, having straight sides of teeth, may be manufactured (the spacing being governed by the use of Johannsen blocks), as compared with the troubles involved in the making of an absolutely correct master gear. A spur-gear testing fixture is generally made with one fixed and one movable mounting for a gear or rack. If the master racks for each pitch are made with a given fixed distance from the pitch line to the back of the rack, the vernier or indicator dial of the movable spindle, upon which the work being tested is set, may always read from the same point.

It should be remembered that manufacturing tolerances of gages must be considered, which will reduce the actual component or work tolerance. It will be observed that in the tables shown the clearances between the shafts has not been considered. Allowance has been made in the tables for close work and that the necessary oil film in the bearing will absorb part of the essential bearing clearance and the remainder will take care of the tolerances in the gages. It should also be remembered that these tables are for production work and that closer fits may be secured by special fitting or selective assembly.

In Tables I and II there are suggested tolerances in widths of tooth space on the theoretical pitch circle and on center distances of shafts. The second column represents an allowance for eccentricity, which is the backlash between two gears that have been cut to the minimum width of tooth space specified in columns four and three. Column four minus column three equals one-half column two. Column five indicates permissible tolerances in the theoretical center distance of shafts; column seven, the greatest possible play between a pair of gears; and column eight, the variations from the theoretical center distance in a gear stand consisting of a bed, a fixed table, in which a master rack slides across the bed, and a movable stud or stand on which a component gear may revolve as the rack slides back and forth.

The information in columns three and four should appear on the drawings of the gears, on which should be placed an outline sketch of the tooth space dimensioned as to the width at the theoretical pitch circle [for a 6 diametral pitch gear, "Cut tooth space 0.0015

Table III—Proposed Tolerances for Close-Fitting Worm Gearing

Applicable to General Ordnance Construction

Threads per Inch	Maximum Separation of Center Distance from Theoretical	Backlash				Maximum Angular Movement in Degrees of Worm Shaft (Assembled Work)	In Fixtures With Correct Theoretical Center Distances	
		Resulting from Increased Center Distances (20 deg. Involute)	Worm	Worm Wheel	Total		Worm and Master Wheel	Wheel and Master Worm
1	0 to +0.003	0.00218	+0.001 to +0.005	0.004	0.01118	4.02	1.8	1.44
1.5	.003	.00218	.0045	.0035	.01018	5.50	2.43	1.89
2	.003	.00218	.004	.003	.00918	6.61	2.88	2.16
2.5	.00275	.002	.004	.00275	.00875	7.88	3.6	2.48
2.667	.00275	.002	.004	.00275	.00875	8.40	3.84	2.64
3	.00275	.002	.00375	.0025	.00825	8.91	4.05	2.66
3.5	.0025	.00182	.00375	.0025	.00807	10.17	4.72	3.15
4	.0025	.00182	.0035	.0025	.00782	11.26	5.18	3.60
5	.0025	.00182	+0.0005 to +0.00325	.002	.00707	12.73	6.35	3.60
6	.0025	.00182	.003	.00175	.00657	14.19	6.48	3.78
7	.002	.00146	.0025	.00175	.00571	14.39	6.30	4.41
8	.002	.00146	.00225	.0015	.00521	15	6.12	4.32
9	.0015	.00109	.00225	.0015	.00484	15.68	7.29	4.86
10	.001	.00073	.00225	.0015	.00448	16.13	8.1	5.4

to 0.00225 in. wide on the pitch line"]. The inspector refers to the table to translate this directly into dial readings on the gage. No better way for checking center distances of the work frame than the usual plug and micrometer method is suggested. Table II modifies the old rule, "cut the tooth space wide 0.005 in. of the circular pitch" as given in some of the gear-cutter operator's instructions, in that 0.006 in. of the circular pitch is the base for column four, for gears having 5 diametral pitch and smaller.

The intention of Table III should be evident after Table II is understood. The gear stand for testing must be provided with a master wormwheel as well as a master worm. There must be no end play of the master worm in the fixture. If there is, close measurements of it should be made and allowed for in the test. A large dial, graduated if possible to hundredths of a degree, is to be fixed to the wormshaft and the backlash measured by noting the possible angular movement of the wormshaft when the wormwheel is locked. It should be possible to transfer the dial from the test wormshaft to the component workshaft. With a component worm and wormwheel of maximum backlash, assembled in their gear case, the total angular movement of the wormshaft representing backlash in the gears and that due to increased center distance should not exceed that noted in column seven. For closer fits than are indicated in this table, special fitting and selective assembly, or some method of adjusting the center distance, will be necessary. Thickness gages cannot be used on worm or spiral gears. Backlash, in bevel gears, cannot be measured by bringing the axis of the gears closer together. It may be that for spur gears of equal diametral pitch and the "no go" thickness gage, if used, applied at the extreme large end of the tooth.

Catching Foremen

BY ENTROPY

The recipe for a wife, "Catch 'em young, treat 'em rough, and tell them nothing," is all right up to and including the first phrase. Most foremen will claim that in their particular cases the second happened, but most of them will agree that they were told something, sometimes quite emphatically.

It is quite the natural thing for the employer to consider some bright young man who is working in the shop as a logical candidate for the vacancy when an old foreman dies or quits. But, strange as it may seem, the fact that a young fellow attracts attention as a workman may have very little to do with his ability to hold the job. A man may be honest, dependable and know his job thoroughly, yet he may be so entirely unable to direct the work of others that he is worth less than nothing.

The general run of shops have a sufficient number of old hands to hide the failings of a new foreman for a long time. So long as the old gang stays and the new foreman knows enough not to disturb their ways, it makes comparatively little difference whether there is a foreman or not. Such men usually become clerical workers, keeping records and doing routine work, rather than active aids to production. Out of a hundred foremen taken as they come, it is a safe bet that more than fifty are of this type. They might be replaced by clerks at half the wage.

But almost every shop wants, and thinks it has, aggressive foremen who will be constantly finding new ways of doing work, recommending improved machinery and appliances, and teaching their men to be more efficient earners. Where can such foremen be found, and what do they look like? Do they need any special training?

A foreman is primarily an executive. He finds his work set out for him. Drawings, specifications, and rules are provided in abundance, but lying between the orders that come to him and the results that he must obtain from them, there is a large field for his own initiative.

Right now some foreman is going to bob up and tell me that in his case there is nothing he can do but what is regulated by rule or custom so that all he can do is to stay in a rut that was worn deep by his predecessor and even the man before him. If this is correct, he is working in a good shop to get away from, but the chances are that his boss is hoping that some time he will come around with some reasonable plan for increasing his profits. Most employers will spend some time listening to anyone that suggests bigger profits. Now it seems reasonable to assume that a man who has done a given job himself should be better able to suggest new ways in which it can be done than anyone else. Still it is almost universal experience that men who have watched one job being done in one way for years do not suggest new ways. The initiative comes from some man who just stepped into the place "casual like," and wondered why the work was done so inefficiently. Until some one catches that germ of leadership and isolates it, and describes it so that it can be sought out in advance, there is not much use in trying to train a man to become a foreman. This does not mean that when a man becomes a foreman there is nothing for him to study, but merely that no man is certain what to study to make himself a foreman.

There was Rob, for example. He worked for the Jones Manufacturing Co. for seven or eight years—came in as a boy, stole his trade and made a corking good machinist. Old Jones had his eye on him for some time, kept telling people that Rob had it in him to be somebody soon. We were all surprised one day to have Rob come around and say goodby. He had another job and was going to it. He seemed a little surprised himself, but it seems that another shop out in Seattle had heard of him and sent word to know if he would leave New England. Rob always wanted to see the country and he bit at the chance without suspecting that the old man had framed up this job with an old friend of his.

Rob got another chance to move six months later and soon after the end of the year he was back with Jones as foreman of the lathe room. And what is more he has made good. He had a fair idea of the business before he stepped out, but he came back with a very different feeling toward his neighbors and the rest of the world—saw them through quite another set of eyes.

Now Rob just happened to have some latent executive ability, but so far as the rest of us could see, old Jones took a long chance on it. He had never been much of a leader and he was certainly not a "joiner." He belonged to no clubs, lodges or anything of that kind, but when he took hold of his job, there was no question but what he was the head of the job. He was a natural-born leader, and, in this case, a thorough "rounding out" makes the man.

Book Reviews

Man and His Affairs. By Walter N. Polakov. Two hundred twenty-seven pages, 5x7 in. Published by the William & Wilkins Co., Baltimore, Md. Price $2.50.

Mr. Polakov wrote "Man and His Affairs," or at any rate the first five chapters of it, to stimulate in the reader "the desire to do some rigorous thinking." By treatment in the abstract he attempts to show, "what man is, what he thinks he is, how he thinks about his affairs, and how he expresses and misinterprets his thoughts." As he says, "the presentation is restricted to a brief sketching out of outstanding points, omitting elaborate proofs and many implications."

In Chapter VI, the last, entitled "Background," and in the appendix, "Making Work Fascinating as the First Step Toward Reduction of Waste," the treatment is more concrete. In those two parts of the book may be seen the application of some of the results of the "thinking" on which the greater part of the book is a treatise.

It is not practicable to attempt to indicate the contents of Mr. Polakov's book in a few words. Each page must be read carefully and thoughtfully, or the ideas presented will not be registered. As headings of the first five chapters he gives "Observing the Observer; Human Class of Life; World of Ideas; Relativism in Human Life; and Language, Logic and Destiny." Mr. Polakov is an engineer and he has held to the engineering viewpoint. In spite of being an engineer he knows how to write.

American Engineering Standards Committee, Year Book, 1925. Seventy-two 8x10½-in. pages. Published by the American Engineering Standards Committee, 29 West 39th St., New York, N. Y.

The 1925 edition of the A.E.S.C. Year Book summarizes in the first twenty-five pages the accomplishments of the committee during the year 1924, the methods of operation and the co-operation of outside organizations.

The remainder of the book is devoted to a list of the standardization projects and of the co-operating bodies. The projects are classified according to their respective fields and immediate subjects. The background of the new year book is one of progress especially in simplified practice.

Machine Design, Construction and Drawing. By Henry J. Spooner. Seven hundred thirty-three pages, 5x8½ in. cloth boards. Published in Great Britain, by Longmans, Green & Co., 55 Fifth Ave., New York, N. Y. Price $6.50.

This volume is the fifth edition, having the addition of eleven new subjects and containing 1,600 figures, 126 tables, and seven inserted plates. The first five chapters are devoted to mechanical drawing, treated so that the beginner should find it easy to learn the art of making working drawings. Although the remaining chapters relate to design and construction, most of the details are either shown with suitable proportions, or are fully dimensioned, with the object of making them useful to the young designer.

The author has shown a great deal of attention to the distribution and transmission of power from prime movers by gearing, belts and wire rope, bringing out the relative efficiencies of their design.

Machine design is covered from many angles. Chapters are devoted to materials used in machine design, the construction of machine frames, machine parts, such as bearing caps, cross-heads, and bearings, the stiffness of machinery, the warping and shrinkage of castings and the use of ball and roller bearings. There are several tables in connection with the strength of bolts, chains, belts, wire ropes, forgings and various kinds of steel, iron and other metals that should be useful as a reference.

The book is intended for use as a text book, having within its pages fourteen hundred forty-six exercises and a selection of examination papers covering design, construction, sketching and drawing. These are included at the end of each of the thirty-two chapters. Some of the subjects included are shafting, crankshafts, journals, couplings, clutches, keys, pins, riveted joints, pipes and pipe connections, cotters, friction gearing, locomotive and engine design and the design of springs.

Power Switchboard and Switching Equipment Handbook. Ninety-five pages, 6x9 in. Published by The Electric Power Club, Cleveland, Ohio. Price 50c.

This is one of the series of instruction books issued by the Electric Power Club of Cleveland for the use of practical men in their field. The first section deals with, and gives practical instruction for, the installation, operation and care of switch boards and switching equipment. A second section contains general standard definitions, abbreviations and the graphic symbols used. Adopted standards and practices are given in the next section, while the last is devoted to safety standards. Central station men, as well as those who handle small, isolated plants, will find this book of value in their work.

Facts and Figures of the Automobile Industry. Ninety-six pages, 6x9 in. Published by the National Automobile Chamber of Commerce, New York City.

There are more interesting data crowded into this booklet than we are likely to find from many industries. Beginning with 4 passenger cars produced in 1895, the industry has grown almost steadily to the present. The 1918 production was approximately half that of 1917, due to factories being used for war work. Last year's production was 3,324,285, a drop of 450,000 from 1923. Truck production has varied but little during the past few years. These figures include the Canadian production of American concerns.

There is food for thought and study on every page, whether it be in the staggering figures of raw materials used, data as to farm-owned vehicles, the growth of buses and truck routes, exports, or other interesting subjects. It is stated that the motor-vehicle industry now tops all others in the value of its products, having passed the steel works and rolling mills in 1923. And this in spite of the fact that automobiles are practically the only commodities that cost less today than in 1913. In other words, 71c. today buys as much automobile as a dollar did in 1913, while general living costs require $1.67 and furniture $2.16 to buy the same amount. These are only a few of the interesting comparisons to be found in the book and they are both illuminating and instructive.

Automotive Production

Tools for Machining Diesel Cylinders, Frames and Bearing Shells

By Fred H. Colvin
Editor, *American Machinist*

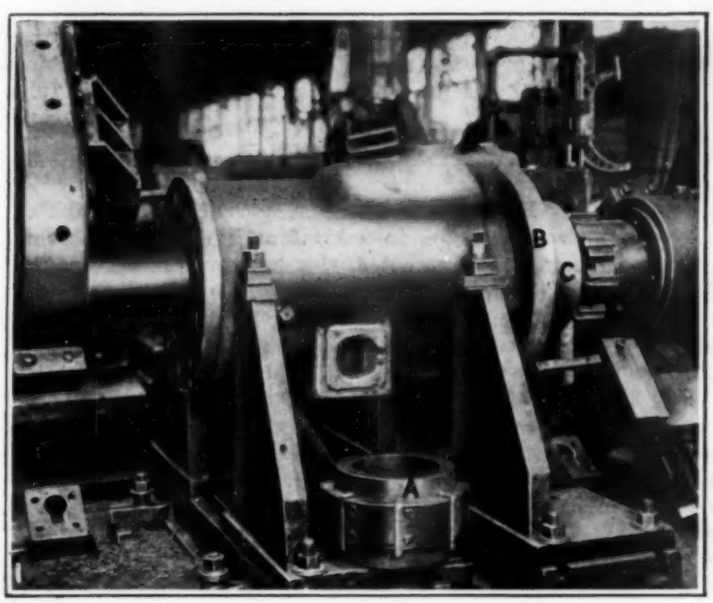
Boring fixtures and tools—Angular milling—Special angle-plate chucks—Roller conveyor for handling heavy work in the turret lathe

AMONG the operations in the manufacture of Diesel engines at the plant of Fairbanks, Morse & Co., Beloit, Wis., is that of boring the cylinder on a heavy, horizontal boring machine, as shown in Fig. 1. The cylinder is located by lugs cast on the outside and rests on the fixture shown, where it is held in position by short clamps. The cylinder is rough bored in the regular way, after which a special cutter head is used for sizing, and also to secure a satisfactorily smooth surface. The special cutter head is practically a large reamer, and is shown at *A*, in front of the fixture.

The ends of the cylinder are faced and the left-hand flange turned. At the other end, in addition to facing the end of the cylinder and also the flange *B*, the projection *C* is turned, using the tool head shown, which is equipped with the regular star feed. The entire boring, turning and facing are done at the one setting.

The equipment for machining the base of one of the smaller engines is shown in Fig. 2. The work is done on an Ingersoll machine equipped with four milling heads, the two side heads being adjustable both as to height and angularity. As shown, the side heads are tilted to the proper angle to surface the sides of the engine base at the same time the cutters in the vertical spindles are milling the upper sides of the longitudinal flanges cast on the cylinder. The machine is motor driven, the motor being on top of the housings.

For boring the crankpin brasses that bolt to the ends of the marine-type connecting rods used in the engine, the special angle plate shown in Fig. 3 is used. The brasses are both located and held by the bolts shown, a shim of the proper thickness being placed between the



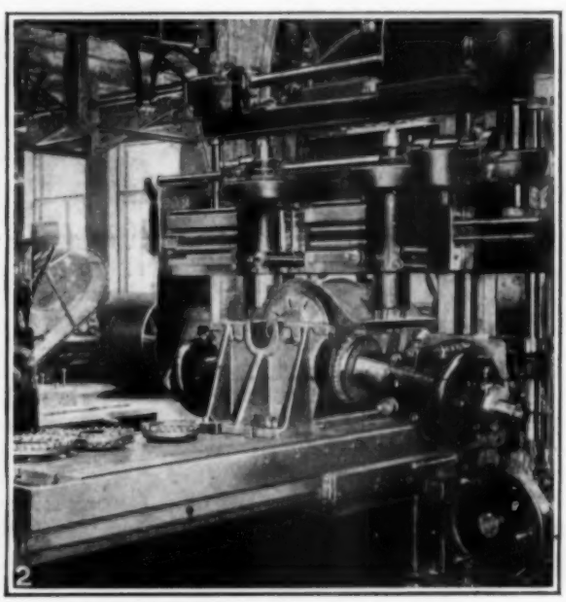
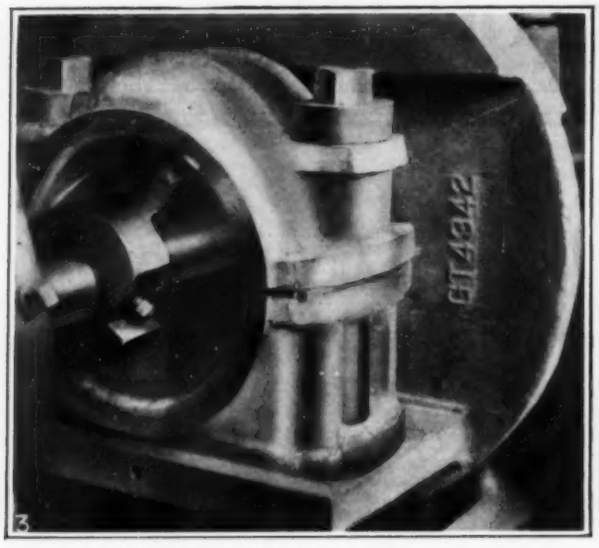


Fig. 1—Boring and facing the cylinders. Fig. 2—Milling an engine base

AUTOMOTIVE PRODUCTION



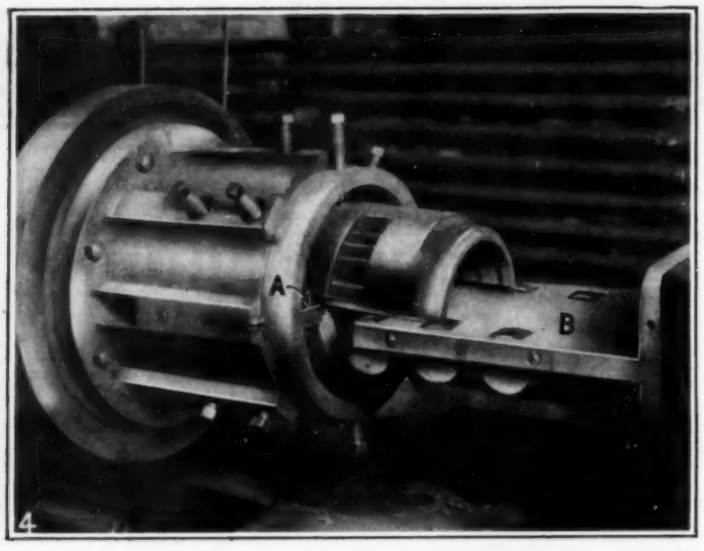


Fig. 3—Boring the crankpin bearing. Fig. 4—Chuck and conveyor for main-bearing shells

halves of the bearing. A counterweight is provided at the other side of the faceplate so as to avoid vibrations due to lack of balance.

In boring the main-bearing boxes, a special pot chuck is used, as shown in Fig. 4, on a large, American turret-lathe. As will be seen, the chuck holds both of the box shells, each being located by means of internal strips on each side of the chuck, one being shown at *A*. The box shells are previously planed so as to fit the locating points, and after they are in place they are held in position by means of the radial setscrews shown.

An unusual feature of this equipment is the roller conveyor *B*, bolted to one face of the turret. This conveyor, which consists of a flat plate, carries 6 rollers. It is necessary only to lift one of the shells on to the conveyor while the turret is in a convenient position, and to swing it in line with the chuck, after which it is an easy matter to roll the shell into the chuck. The illustration shows one of the shells being removed after boring, and gives a good view of the dovetailed grooves for holding the babbitt lining.

Abstracts

from other publications

Cutting Foundry Costs

The cleaning room of the Ferro Machine & Foundry Co., Cleveland, Ohio, is laid out and equipped for the economical cleaning of cylinder castings through the saving of man power. The work moves, as far as possible, in a straight line from the time the castings reach the department until they are cleaned and loaded on cars for shipment. The handling is done largely on conveyors and only two truck operations are required for the largest unit handling Chevrolet cylinder castings. With the established speed schedule a Chevrolet cylinder reaches the loading car three hours after leaving the core knock-out machine. The cleaning department has a capacity for 3,000 cylinders in a nine-hour day, 2,000 of the Chevrolet type and 1,000 of the larger types. The shop itself is 100x204 ft. Adjoining it on one side is a core knock-out department 70x100 ft. and at the opposite end is a 60- by 160-ft. salvage department.

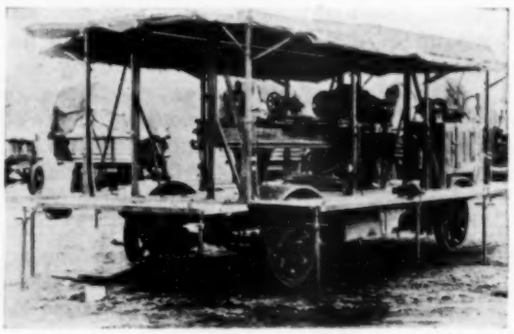
Chevrolet cylinders are all cleaned in tumbling barrels and the larger cylinders in sand-blast rooms. The 20 tumbling barrels are set in two parallel rows. They are square barrels with a capacity of 26 castings each and the cylinders are tumbled for two hours. The Chevrolet castings weigh 120 lb. and can easily be handled by two men. Back of each row of tumbling barrels are the chipping benches, each chipper having a complete installation with individual connections for air and light, while wire-mesh screens separate him from his neighbor. There are 32 chipping benches to cover a production of 2,000 cylinders in nine hours.

The salvage department alongside is used for the repairing of defective castings by oxy-acetylene welding, there being five stations provided—*Iron Age*, July 2, p. 1.

Cleaning Parts

Elmer Knox, production manager of the Yellow Cab Manufacturing Co., in a brief article states that this company has eliminated the human element in the method of cleaning metal parts. To secure the even flow of production through the cleaning division, they installed a metal parts washing machine for preparing automotive parts for assembly or painting. This machine contains both washing and rinsing apparatus and a drying oven has been added. The oven is of particular advantage for parts that have to be painted since it forestalls the possibility of paint peeling in spots where minute drops of water are left. An automotive conveyor feeds the parts into the washing machine and takes them through the rinsing and drying operations. There are four sets of rapidly revolving nozzles, two above and two below.—*Factory*, July, p. 62.

Mobile Ordnance Repair Shops



Mobile ordnance repair equipment will be featured at an exhibit of ordnance materials at the seventh annual meeting of the Army Ordnance Association at Aberdeen Proving Ground October 2

By Major-General C. C. Williams
Chief of Ordnance, United States Army

THE complexity of modern ordnance material used by a large army of the present day requires that adequate provision be made for maintaining this mechanical equipment in the hands of the fighting forces in serviceable operating condition. It is readily seen that the time of greatest need for prompt repair and maintenance of an army's fighting equipment is during its participation in active operations. The relatively long lines of communication of modern warfare and the congestion of all available lines of supply during an engagement dictates the advisability of establishing mobile repair facilities within the zones of the fighting armies and in direct contact with the troops. Such a maintenance organization insures the expeditious repair of damaged material and the continuous maintenance of the fighting equipment in the best possible condition. To transport ordnance material to the zone of the interior for any but major overhaul or rebuilding would require considerable time during which this material would be out of action and such a system would, in addition, add a large burden to the already over-loaded transportation facilities.

The mobile repair shops supplied by the Ordnance Department are of the light and heavy types. One of these light shops forms a part of each infantry division. It is especially equipped for maintaining the ordnance material used within the division, consisting of rifles, automatic pistols, automatic rifles, machine guns, infantry mortars, and cannon, divisional artillery and fire control equipment of all types. The heavy shops operate further to the rear than the light shops and are especially equipped for maintaining heavy artillery, tanks and automotive equipment, and, in addition, function generally as a second echelon of repair facilities supporting the light shops.

Prior to the mobilization of the United States Army on the Mexican Border in 1916 the field equipment of our army did not require extensive shop facilities for repair in the field. Each company of infantry and battery of artillery carried with them, as part of their field equipment, a supply of spare parts for the maintenance of their ordnance equipment. Additional spare parts and necessary repairs were furnished by the nearest ordnance depot. During this mobilization of 1916 the necessity for mobile repair facilities with the army in the field appeared to be desirable in order to insure not only that equipment would be in a serviceable condition, but that there would be conservation of equipment by expert repair. Improvised mobile repair shop facilities used at this time served to indicate the advantages of such equipment and trained personnel for maintaining modern ordnance equipment in the field.

Upon the entry of the United States into the World War, the work of designing and building mobile repair shops was immediately undertaken as part of the material necessary for our armies. This shop equipment had to be selected to care for a wide variety of repair work, including machinery and tools, for repairing metal, cloth, leather, and wood, and special tools for repairing infantry, artillery, and automotive equipment. Mobility was accomplished by mounting some of the tools on trucks and some on trailers. The equipment of the light repair shop was mounted on trucks for the purpose of rapid movement with the combatant forces, while part of the heavy shop equipment was mounted on trailers which would be capable of rapid movement using tractors when occasion demanded.

The shop equipment for the light mobile shops consists of the following:

Trucks, Light Repair
" Artillery Repair
" Artillery Supply
" Small Arms Repair

The light repair truck consists of a light truck body on a commercial chassis. Several chests containing a variety of machinist's and carpenter's hand tools and chests of light supplies, such as lubricating material and automotive supplies make up the load.

The artillery repair truck is a commerical truck chassis to which has been fitted a special body. The tool equipment includes all the essential tools of a small machine shop, and is also suitable for a wide variety of bench work. There is a lathe, drill press, complete engine-generator set for generating the current to run the machines, a grinder and an air compressor set with air tools. Other equipment consists of complete bench cabinet, acetylene welding and cutting unit.

The shop equipment truck is used in the light shop organization for carrying stock, equipment, and spare parts necessary for the particular unit of the army to which the shop is attached.

The small arms repair truck used in the light repair unit carries a sewing machine and stitcher, manually operated, for the repair of leather and cloth material. In addition, there are hand tools and kits for the repair of personal equipment, machine guns, rifles, pistols, etc., and a wide variety of small tools suitable for work of a general nature.

For making heavier and more extensive repairs, the Ordnance Department supplies the heavy mobile shop equipment described in the following paragraphs.

The light repair, the artillery repair, and the shop equipment trucks in the heavy shop are identical with those of the light shop.

The office truck is especially arranged for handling the office part of the shop. Drawers, cabinets, and a drawing table are provided for records and drafting work. In addition, this truck carries an ambulance box and first aid equipment. The chassis is commercial with the artillery repair truck body.

The power saw truck carries a power saw for wood and a 20-ton garage press. The power saw is driven by an electric motor. This truck does not have its own power generating equipment but receives power from the power plant trailer which supplies power for all shop trucks and trailers except the artillery repair truck. The truck body is the artillery repair truck mounted on a commercial chassis.

The spare parts truck is a commercial truck chassis with an artillery repair body. No special equipment or load is specified, as these vary with the organization being served by the shop.

The toolroom truck is fitted with a large number of cabinets for the storage of small tools, measuring devices, attachments and supplies. The only motor-driven tool is a grinder. In addition, there is a key-bitting machine manually operated.

The air compressor truck supplies the compressed air for all purposes in the shop. The body is an artillery repair truck body upon which is mounted the gasoline engine-driven air compressor unit, an oil-fuel forge, and cabinet work benches having a full set of air tools, such as riveting and chipping hammers, pneumatic grinders, and drills.

The trailer vehicles of the shop equipment consist of a 4-ton shop trailer with a machine shop trailer body. The equipment trailer does not carry any machinery or tools but is intended for the transportation of all baggage, and personal equipment of the Maintenance Company.

The bar stock and hack-saw trailer carries a power hack-saw driven by an electric motor which receives its current from the generator trailer. A bar stock rack is mounted in the center of the trailer. Two vises are mounted on the rack.

The drill press trailer equipment consists of a work bench with electric panel, a 22½-in. upright drill press, a 16-in. shaper, 3 vises and a complete set of tools and accessories. The drill press and shaper are driven by electric motors, power for which is received from the central generator trailer.

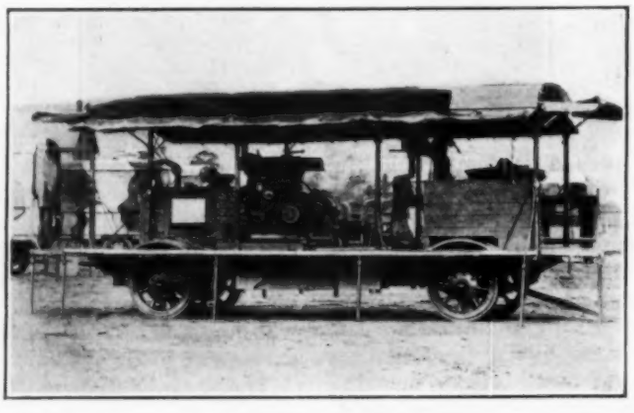
Electric power for the shop trailers and trucks equipped with motor driven machine tools or electric lights is furnished by the generator trailer. The power plant consists of two direct connected 15-kw. gasoline-electric generators with switchboards, work benches and a supply of tools and accessories. Suitable receptacles are provided for the power leads to the trailers and trucks in the shop group.

The lathe trailer equipment consists of an 18-in. lathe with a crane and hoist for serving it; other equipment consists of two grinders, arbor press, bench vises, work bench, electric panel and the usual assortment of lathe tools.

The milling machine trailer has five motor driven machine tools, a universal milling machine, a 6-in. and a 9-in. screw cutting lathe, a bench drill, and a tool-post grinder. In addition, there is a complete assortment of tools and accessories for each machine tool. The standard work bench with an assortment of hand tools completes the equipment on this trailer.

Spare parts and stock for the shop are carried in the parts stock room trailer and the parts and stock room bin trailer. These two trailers are not equipped with machinery, but carry spare parts for the use of the particular organization to which the shop is assigned, and a stock of standard equipment, such as screws, bolts, wire, pipe fittings and similar material.

The welding and forge trailer has a very complete outfit for all kinds of welding and forge work. The principal equipment consists of a forge with shield, an acetylene generator complete, an electric arc welding unit, a floor grinder and the usual accessory equipment found in the forge shop, such as vises, anvil, work benches, swage block, welding tables and similar equipment.



Drill press trailer

These light and heavy mobile ordnance shops are manned by personnel of the ordnance maintenance companies of Ordnance Department, and when in the field, in addition to the shop vehicles, there are added a certain number of motorcycles, passenger cars, and kitchen trailers, required for administration of the shop.

The mobile shop equipment supplied by the Ordnance Department to our field armies fills a very well defined need. This equipment is quite extensive and very complete in every detail, to maintain munitions in the best possible condition.

The Training of Welding Operators

By W. J. Meadowcroft
Edward G. Budd Manufacturing Co.

The qualifications and training of welding apprentices—Problems of maintenance and the operation of oxy-acetylene apparatus—Rules of safety

THE larger manufacturing companies needing welders for their production work are using a system of apprenticeship that can be compared favorably with that for training machinists or any other men engaging in a trade. The Edward G. Budd Manufacturing Co., has equipped an apprentice shop or class room for this work.

The men for this training are chosen according to their knowledge of mechanical work, their natural ability and alertness. Previous experience with a welding torch on lead burning or brazing is desirable especially for those who are to be placed on production work. Their eyesight must be normal, and their hands must be in good condition. Other physical conditions such as size and weight are not so important as quickness of mind and body. They are required to have at least a grammar school education.

When the applicants for apprenticeship are accepted, each is required to purchase a small monkey wrench, a pair of welding goggles and a pair of canvas gloves. When the apprentice has his equipment he is sent to the classroom where he spends from two to six weeks according to his ability to pick up the methods of operation of the welding outfits. A photograph of a welding class is given in Fig. 1, which shows the methods of arranging the apparatus and the benches. In accordance with the class of work of this company, they are trained on light gages of sheet metal. The work of one apprentice, illustrated in Fig. 2, shows clearly the progress he has made during the twelve days of his training.

This system has proven satisfactory and is one which any manufacturing plant training its own welders may use for a model. The first lesson that should be taught the apprentice is safety. Stress should constantly be placed on the rules of safety so that they will be adhered to at all times. Other rudiments of welding training are the proper care of the equipment and economy in the use of the gases and wire. If everything is in first-class condition at all times, the chances of mishaps will be greatly reduced, and the care the welder takes of his outfit may also serve as an index of his efficiency and diligence.

The rules the operator must learn are not many, and are comparatively simple, but they are absolute in character, and must be followed constantly and exactly.

Fig. 1—Training shop for apprentices in welding

In the first place, when attaching the regulator to oxygen cylinders, the cross-bar should be released by turning it to the left until all pressure on the interior tension spring is relieved. This is of vital importance and must be done to prevent the high pressure in the cylinder from injuring the inner works of the regulator. If a regulator is damaged in this way, it should be immediately sent to the repair department.

After the regulator is attached to the oxygen cylinder, the operator is ready to turn on the oxygen valve. When turning on the valve he should always stand in the rear of the cylinder so that in case an excessive pressure should burst any part of the regulator he will escape injury. The amount of pressure used in the oxygen hose line should at all times be regulated according to the amount stipulated on the pressure cards supplied by the manufacturer of the equipment he is using.

When the torch has been attached to the hose lines and is ready for use, the acetylene valve should always be opened first. The oxygen will not ignite but if both valves are open at the same time, a flash back will be likely to occur.

The oxygen operates at a higher pressure than the acetylene and this will allow the gas of the lower pressure to mix with the other in the hose line, thus causing an explosion.

When lighting a torch you can determine whether the pressure of the acetylene is sufficient by the manner in which it blows away from the tip. The pressure, however, should always be measured with the pressure gage. Enough pressure should be used from the oxygen cylinder to obtain the neutral flame. The neutral flame is the proper one and it will give a heat of 6,300 deg. F. or 3,468 deg. C. The changing of the size of a tip changes only the volume of the heat. When too much acetylene is used the flame will be carbonized. This condition makes the weld hard on the surface and prevents proper fusion within. On the other hand too much oxygen will impart an oxidizing power to the flame causing brittleness and porousness of the weld.

After closing the valves on cylinders, the torch valve should always be opened in order to allow the gases to escape from the hose and regulator. The cross-bar of the regulator may then be unscrewed and the torch valve closed.

Welding stations should be placed in sections of buildings where it is impossible for grease or oil to come in contact with cylinders of oxygen, in order to prevent any possibility of an accident caused by spontaneous combustion.

In training the apprentice, the instructor should lay much stress on the flash back. The flash back is usually caused by the overheating of the tip, the reducing of the flame without changing the tip, improper regulation, bad conditions of the torch, irregularity of the mixture and flame or the projection of collected sparks on the working end of the tip. If a flash back occurs, the operator should close both valves slowly and cool the torch in water. He can then wipe the tip and begin operation again. When the valves are being closed, the acetylene valve should always be closed first, since it controls the combustible gas. The occurrence of a flash back will coat the inside of a torch with carbon, and if repeated flash backs occur, the tip must be removed and thoroughly cleaned.

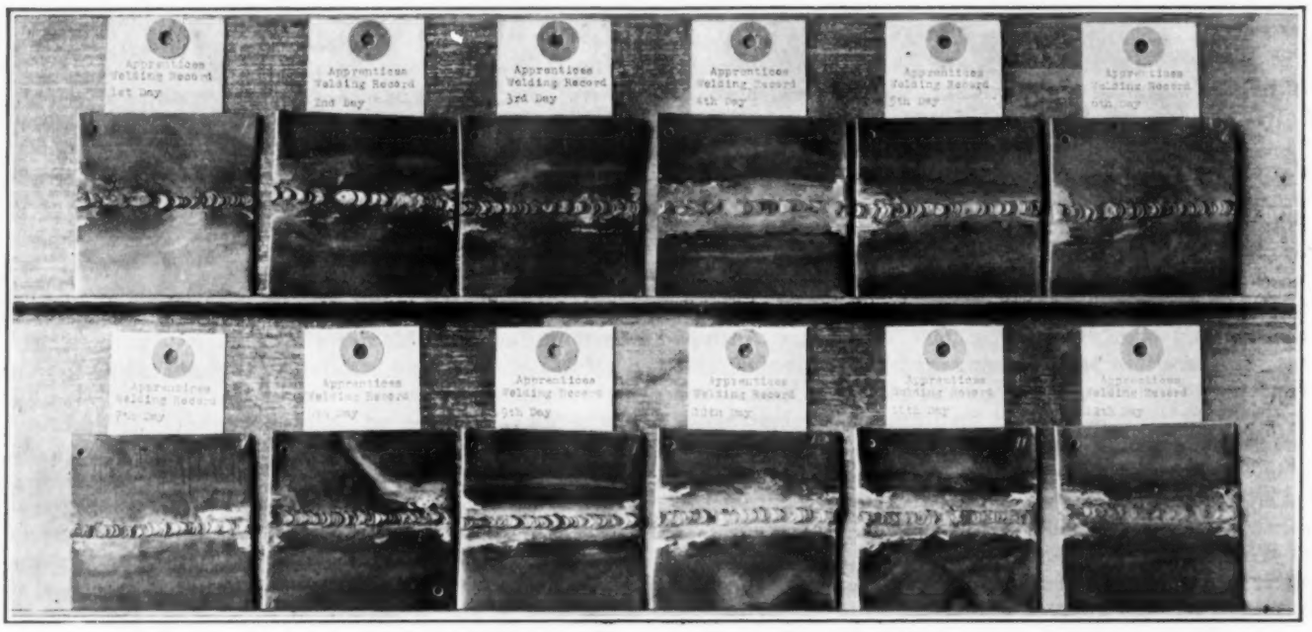


Fig. 2—Record of the progress of an apprentice

Another of the important lessons for the welder to learn is the care of the tip which is the most important part of the torch. The tip should never come in contact with a hard material of any description, nor be allowed to drop on a concrete floor. To clean the tip, a copper wire alone should be used. Never allow the tip to be rubbed on an iron or wooden bench, nor reamed with a steel wire.

Each time a new oxygen cylinder is connected, the hose line and the valves of the cylinder should be inspected. A leak in the acetylene tank may be detected by the odor, but this method will not apply to an oxygen cylinder. It is necessary in order to detect a leak, to raise the pressure in the oxygen hose line by turning the cross bar to the right until the line gage shows a pressure of twenty-five pounds with the torch valve closed. When the cross bar is turned to the left and the regulator pressure is released, if there is a leak present

in the line, the gage will slowly return to zero. The speed at which it returns will indicate the extent of the leak. If the gage does not return, there is little possibility of leak in the line. In case a leak is found at the ground seat where the regulator is attached to the cylinder at the connecting nut, loosen the connecting nut a few threads and quickly open and close the cylinder valve. This process will remove any foreign body that may have been between the seat of the regulator and the cylinder valve. In case this method does not check the leak, the regulator should be exchanged. Unless hose clamps are used in making connections, a piece of friction tape must be wrapped around the hose to prevent the wire from cutting it.

Operators should be cautioned to place cylinders on their sides unless they stand in regular holders. The result of tipping one of these 150-lb. cylinders upon some one standing near may easily be surmised. A cylinder seldom falls without making necessary the repair of the regulator.

Welding Sheet Metal

Sheet metal $\frac{1}{64}$ in. to $\frac{1}{32}$ in. thick at molten heat is very sensitive to oxidizing or carbonizing and consequently an absolute neutral flame must exist at all times. This sensitiveness makes the welding of light gage sheet metal much more difficult than the welding of other metals. It is necessary to use more care in the selection of wire or filler material, and the size of the wire is an important factor.

The tip to be used for welding sheet metal must be of the correct size. A tip that is too large will not only cause buckling of the metal, but will also make the welded surface hard and porous. If too small a tip is used, there will be an insufficient amount of fusion, and weakness will result.

In welding sheet metal, it is necessary to moderate the amount of heat, and the size of the filling material. If the wire is too large, the metal will burn before the filler becomes molten. If the wire is too small, the wire will burn before proper fusion takes place. The wire itself must be pure iron and entirely free from low carbon contents or other impurities. The most popular welding wire on the market today is guaranteed to be 99.84 per cent pure iron.

Impress upon the apprentice the rule of economy. High-grade wire costs money and the operator should weld the short ends to a new wire or rod. Never allow wire to lie loosely on the floor where it will usually become damp and, in a short time, rusty. When an operator has allowed wire to become rusty he has destroyed what the manufacturer of the wire has been so careful to obtain—purity. When the material melts, the rust or oxide will be carried into the weld. Rusty wire will cause such imperfections as pits, blow-holes and indentations. These imperfections result in difficulty in enameling. The indentations in the weld act as a reservoir for the japan and will produce a blister when the enamel is applied and baked.

In welding sheet metal, the flame is brought down to the line of weld at an angle of 70 deg. The point of the flame should just touch the metal. The material should be molten completely through before the welding wire is applied. The thorough heating of the material is essential in order to reproduce the same conditions in welding as in the original casting of the pieces. Thorough and even heating will increase the strength of the weld from 70 per cent to about 98 per cent of the original strength of the material. In cases where great strength is required, the weld should be built up on both sides. The operator should be careful not to spread the neutral flame over any greater area of the metal than the part to be welded.

In welding a curved piece little difficulty is encountered, but in flat sheets precautions must often be taken. The sheets may be either clamped or tacked together by $\frac{1}{8}$-in. to $\frac{1}{4}$-in. tacks before welding. These methods are usually sufficient to keep the edges even and to give a flat surface at the joint or weld. Sometimes, however, it is necessary to use wet asbestos on the line of weld. A weld which has buckled the metal not only must be restraightened, but it often discolors the metal to such an extent that it needs considerable polishing.

In conclusion let me once more impress upon the operator the importance of safety in connection with sheet-metal welding. Always allow for the usual precautions such as glasses, goggles, bursting disks and water seals. It would seem rather obvious that welding wire must not be recklessly handled, but have you ever stopped to consider how easily a passerby could be injured by the welding wire that projects over the operator's shoulder? It is exactly the right level to strike the face. To eliminate this hazard entirely, every piece of welding wire should be bent on the free end. By turning down this loose end, the use of welding wire will become safe.

Hiring Drafstmen

By John F. Hardecker

"Jack," said Bill Brown, chief draftsman of a large manufacturing concern to his friend, "do you recollect my telling you we had to take on ten new draftsmen in a hurry several weeks ago due to that big rush contract we got in at that time?"

"Yes," agreed Jack, "you had to run an ad in the daily papers and depend on that for your men."

"Well," continued Bill, "though we had plenty of applicants, I now find we only got about two real draftsmen out of the ten I hired. Due to the emergency of the job I hired them pretty much on the basis of their past experience records and what recommendations they had with them, or that I could check readily on the phone. The experience and recommendations of those I hired should certainly have given me a better percentage of real draftsmen."

"That's about what we used to do," agreed Jack, "but without any more satisfactory results either. But now I save a lot of time and hire or reject a man at his first interview, by actually finding out for myself what he does know about the real fundamentals of the game. I put some elementary questions on strength of materials, projections or trig to him—the kind that bear about the same basic relationship to his field as the multiplication table does to arithmetic.

"If he says he can't do the problems without his handbook I furnish him with one. If he can answer the questions in an intelligent way, not necessarily one hundred per cent correct, its a fairly safe bet he'll be a good man for our organization. If he doesn't know what it's all about, but merely assures me he can do the work if I'll give him a try, it's also a pretty safe bet that he's learned the trick of drawing pictures for other people's ideas, and that we don't want him."

Practical Hints on Removing Buckles and Dents from Sheet Metal

By E. Andrews
Manchester, England

ALTHOUGH much information has appeared during the past few years upon the subject of machinery to rapidly and cheaply produce the wide variety of objects now made from sheet metal, little, if anything, has been published upon the art of smoothing, straightening out and removing dents or similar defects from sheet metal or sheet metal parts.

In view of the fact that sheet metal is now so extensively used in automobile, aircraft and railway passenger-car construction, a few remarks from one who has had several years' experience along the lines indicated, should be of interest to the industries involved.

The flattening of sheet metal or the removal of dents from damaged parts, often presents difficulties to the inexperienced mechanic that are merely apparent and may be easily overcome by a short study of the subject. Through ignorance or the non-observance of a few simple rules the task, elementary in reality, becomes a tedious, laborious and time-consuming operation.

Study and Practice Needed

There is nothing mysterious about the art; it is experience, chiefly, that is required. A little study of the principles involved, a few inexpensive tools, and a considerable amount of tentative experiment will enable the average worker to become proficient.

In flattening sheet metal, the object to be attained is the even distribution of the metal itself. If it is too loose in one place it must be stretched by hammering it in another place where it is too tight, until there is the same amount of material all over the plate, or, I might say, until the metal at all points of the surface is in a state of rest and not under tension, as the latter is really the cause of the unevenness.

In the production of sheet-metal plates that must have a dead flat surface, as in some parts of railway passenger-car work, it is customary to attach powerful clamps to the edges of the sheets and place them under tension, the strain often being so great as to tear the edges of the sheets.

There are several other ways of attaining the object, such as putting the sheets through a series of suitable rolls, flattening under a power-driven planishing hammer, putting them between plates in a hydraulic press, or by hand-planishing methods. If no great quantity of material is to be handled, hand-hammering as here described is perhaps the best method.

If the center of a sheet has a buckle in it, the edges looking fairly straight, then there is more material at the center than at the edges. A few well-disposed hammer blows, working from the outer edges inward, with the majority of blows along the edge and easing off toward the center, should make the work flat. This treatment may, however, result in leaving a number of smaller irregularities, and these should be taken out by working cautiously in a similar manner, taking care never to hit a raised buckle but delivering the blows upon the area surrounding it.

If the sheet be laid upon a flat surface and pressed with the finger, it is generally possible to discover where the metal is loose and where it is tight. Then free that area which is tight by a few judicious blows with the hammer. Be very sparing with the hammer after having once gotten the sheet nearly flat. When working upon aluminum or any other soft metal it is advisable to use a flatter made of the same material so as to prevent marking the work.

If the sheet is tight at the center and slack at the edges it will have no buckle, but will cross-twist in the hand, will be very uneven along the edges and will not lie level on a flat surface. Such a piece requires the most hammering at the center and very little at the outer edges until it will lie level of its own accord.

Care must be taken not to mar the surface by producing "crescents" with the edge of the hammer face. Planishing tools should be perfectly smooth and clean, as a faulty hammer or anvil will injure the surface of the metal very quickly. The surface of the anvil or block used in the flattening operation should be fixed at a height that will enable the worker to secure maximum results with a minimum of effort. The height recommended is about level with the upper part of the worker's thigh.

It should be borne in mind that hammering on sheet metal cannot contract it; it can only expand. A blow will always cause a depression, however slight, upon the surface struck. If a flat plate had simply to be stretched without altering its form, the best way to do it would be to hammer regularly upon alternate sides until the result was accomplished.

Annealing Helps

It is good practice to anneal the sheet of metal in the immediate vicinity of the damaged part in order to insure an equal flow and to minimize the danger of fracture. If the material is brass, the annealing can be done by heating it to a dull red heat (600 to 650 C.) and allowing it to cool gradually. Copper should never be annealed in a freshly made coke fire, since the sulphur in the coke will attack the copper. Certain atmospheric gases also have a deleterious effect upon copper at high temperatures.

The best way to anneal copper is first to turn on the blast and blow up the fire until it is an incandescent mass, then shut off the blast and lay the copper on the fire. As soon as it reaches a dull red, it should be plunged in cold water. Aluminum should be heated in the same way, but to a much lower temperature (400 to 480 C.) and may be cooled quickly in water or more slowly in air.

Advantage in Hot Working

In the case of iron or steel sheets or objects, it is sometimes of advantage to heat them red hot and hammer them while hot, but they should never in any case be cooled in water. Articles made from tin or terne plate, or electroplated ware, cannot be annealed for the reason that the heat would destroy the protective coating.

If the article to be restored is a closed vessel, or for other reason there is no means of working from within, a piece of stout wire should be soldered to the middle of the dent and the metal pulled outwardly by it. After the surface has been restored the wire can be melted off.

Sometimes when a dent is not removed entirely by this method, a few light blows with a flat-faced bright hammer, delivered around the indentation, will greatly

improve its appearance. If the material is polished aluminum, brass or copper, a sharp scraper and a piece of fine abrasive cloth should be used to remove every trace of solder, after which rotten stone and oil or a greasy tripoli compound may be used to restore the polish, finishing off with dry, powdered lime.

If the article has an opening large enough to permit the introduction of a suitable head, the dent, or bulge, can be straightened out by placing the article on an iron head and manipulating the hammer so that while the dent rests upon the head, the blows will be delivered on each side or around it. Judicious but persistent hammering will restore the original shape.

Filling with Solder

In the case of articles damaged by having a number of small dents in places that are not readily accessible to the tools, it is often more economical to fill up the dents with common soft-solder. A solder composed of 30 per cent tin and 70 per cent lead, worked at the right temperature and with a suitable flux, will be found quite satisfactory. After filling the dents, the solder can be smoothed with scraper and file, after which the surface should be rubbed with fine abrasive cloth and finished as before described. The area of the indentations and the surrounding surfaces must be thoroughly cleaned before the solder is applied.

Success in soldering depends in great measure upon the use of a suitable flux. Zinc chloride has the desirable attribute of remaining liquid at soldering temperatures, and is thus in condition to act readily upon the oxides. Some mechanics add a quantity of water to zinc chloride, but this is detrimental for the reason that the stronger the flux can be made and still remain liquid, the better it will be. All traces of the flux should be removed after the operation in order to avoid subsequent corrosion of the metal.

In some case it may be advisable to apply a patch over the damaged area; in which cases a good body of solder should be applied around the edges of the patch, holding the patch down firmly during the process and until the solder has set. The repaired part should then be leveled and smoothed by means of files, scrapers and abrasive cloth, as before described.

Repairing Tubular Pieces

To remove dents from copper, brass or aluminum tubing, obtain a number of steel balls of a size equal to the inside diameter of the undamaged portion of the tubing, and drive them through it. The tubing should be thoroughly annealed at the spots where the dents appear. A little plumbago sprinkled on the balls and in the tube will facilitate the operation.

If the damaged tube is large enough to permit the introduction of a bar of steel or iron, the straightening operation is much simplified. The bar should be held rigidly in a vise or by other means, the tube slipped over it and the dents removed by hammering around them until the original shape is restored.

The fact should be emphasized that one cannot be too careful to bring the hammer down flat upon the surface of the metal every time, otherwise crescents will appear as previously indicated, and it will be found exceedingly difficult to obtain a smooth, flat surface. Proficiency in using a hand hammer to flatten and planish surfaces of sheet metal can be acquired only by practice. Written instructions without practice are worthless.

Seen and Heard

By John R. Godfrey

Changes in machine shop personnel

I hear a lot of discussion about the changes that have taken place in machine shops in twenty years, and particularly in shops building machine tools. Twenty years ago, the proprietors and managers were practically all mechanics—men who had come up through the shop and branched out for themselves to build a lathe or drill press that they thought was better than the one built in the old shop.

It didn't cost much to start in business in those days, and such details as overhead, depreciation and obsolescence hadn't been discovered—at least not by those names. A few of the men had good business heads on them and made money. The great majority, however, either struggled along, making a fair living or else petered out after a few years. Any of us old-timers can count dozens of those who built machines and then dropped out of the game.

Then business men from other lines began to buy into the machine tool game and the mechanics looked after things in the shop. In many cases this was a mighty good thing, since the new managers had business training and knew what overhead was without a special introduction. Many of the shops prospered as they never had before, and the combination seemed to be ideal in many ways.

Now, according to some of my good friends pretty close to the situation, another change is taking place. The mechanic with an interest in the business is disappearing altogether and leaving only the business man in charge. In some of the after-war changes we find a banker's representative in charge, with no ideas as to the machines and only interested in the balance sheets.

In one such case, the situation has reached the point where the concern is doing a very good business, in volume, but in which the *net* is conspicuously absent. Experts have been called in and the product is being changed to make cheaper production possible. But, since there is no one in the plant with both mechanical ability and financial interest in the concern, the outlook isn't very hopeful. The new designs may save money enough to show a profit for the time being, but without someone in the shop with a real stake in the business, it is only a question of time when the same condition will be repeated.

There's nothing like a financial stake in a job to keep anyone interested, whether he's the helper or the shop manager. I know of more than one shop where, in hard times, the founders have had to relinquish most of their holdings to get money enough to keep going. And now they own so little, have such a small interest, that they have lost heart and plod along without making much of an effort to boost the earnings. A bonus, or better yet, a chance to buy back at least part of their stock at a fair price, would hearten them so as to call forth every effort.

Some of my level-headed friends believe this is a point that can well be carefully considered by the present-day management—both banker and otherwise. An appreciation of the human side of business is often the best way to increase dividends. It generally pays to insure a real personal interest by making the other fellow feel that he really "belongs."

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

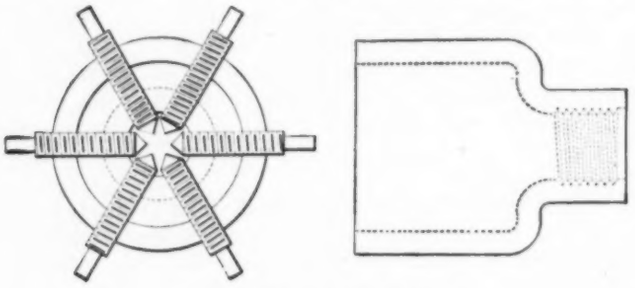
A Cheap Bell-Chuck

By W. Mason
Liverpool, England

Though I will admit that a row of bell-chucks in burnished gun-metal or brass presents a very attractive appearance, yet there are many who, no doubt, are unable or unwilling to pay the high price demanded for them. For instance, a 2-in. bell-chuck made of gun-metal may cost as much as eight dollars, and is probably not too dear if we consider the actual cost of material and labor. Chucks of this class may be made of iron castings, but there is then a considerable amount of labor involved in finishing them; labor that many persons have neither time nor inclination to undertake.

Probably there are few people who have not noticed at one time or another the "reducing sockets" used so extensively by gas and water fitters to connect large pipes to those of smaller diameter. Such fittings may be obtained up to 6 in. in diameter at the large end, with the opposite end considerably reduced. They are just the shape required for bell-chucks, and, being of wrought iron and of about ¼-in. in thickness, are of very great strength.

Assuming that a 2-in. bell-chuck is desired and that the spindle nose has a ¾-in. thread, a reducing socket of a size known to the trade as 1½x¾ in. will be required.



A cheaply made bell-chuck

Mounting this by the larger end on a faceplate or in a self-centering chuck, the first operation consists of turning out the existing thread in the smaller end and enlarging the orifice until it is of sufficient size to permit the ¾-in. tap to be introduced. In tapping, it is well to bring up the tail center to support the outer end of the tap so that the threads may be in alignment.

A small recess, as shown in the sketch, should also be made at this setting, and, if the foregoing operations have been carried out carefully, on screwing the rough chuck on the mandrel it should run true and bed nicely against the shoulder.

With the mandrel and chuck in place in the spindle of the lathe and the lathe in motion, a graver or point tool may be used to mark two rings on the larger circumference. Each ring is to be divided into six divisions. Drill and tap for ¼-in. screws at three points on each ring, taking care that the three holes in one ring are midway between those in its fellow. By making six divisions in each ring when only three holes are required, it is possible to do the drilling in the lathe with the work supported and advanced to the drill by the point of the tail center, thus insuring the proper radial positions of the respective screws.

The chuck now requires only to be furnished with screws to complete it. It is hardly worth while to make them, seeing that they may be so cheaply purchased. The heads of the screws should be cut off and a square filed upon each one; the opposite ends being slightly coned as shown in the sketch.

The screws should be made a medium fit in the chuck; neither tight nor loose, but so they may readily be turned by the fingers. For light work a spanner is hardly necessary, but one will be useful for heavier work and can easily be made by broaching or filing a square hole in a suitable piece of metal. A shaving may then be taken from the mouth of the chuck, and the body turned up bright and smooth if thought desirable; but a very good plan is to give the outside one or two coats of a durable enamel.

If a larger chuck, of—say—4-in. diameter, should be required, it will not be possible to obtain a socket small enough at its reduced end to fit the spindle, but it is easy to overcome this difficulty by plugging the small end and drilling it out afresh to the required size for tapping.

The total cost of such a chuck is small, exclusive of time and labor, and when finished it will be found of great value to hold many articles while being turned. For large drills it will be found even better than a self-centering chuck, as with a little practice any piece within its capacity can be adjusted so the drill will run true.

Making Large Ball Races

By C. D. Michener

The immortal Chordal once remarked that "The capacity of a Simon Pure machine shop is regulated by the size of the front door." This has a counterpart in the saying "It pays to try anything once."

We needed a large ball bearing in a hurry and had to make it ourselves, and our greatest difficulty was in grinding the races after they were heat-treated.

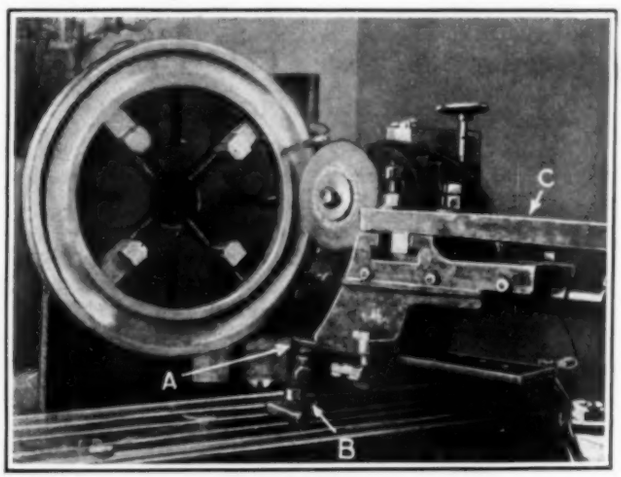
IDEAS FROM PRACTICAL MEN

Since we had no furnace for heat-treating the races, we built a wooden furnace of tamarack and fir, using 4x10-in. timbers. The furnace was built on a forge and gave an intense and even heat, easily regulated.

The races were suspended, one at a time, from a rod to which a crank was attached, and were slowly revolved during the entire heat, resulting in even heating.

We got out of our grinding difficulty very nicely by using a portable grinder mounted as shown in the illustration.

The races were held in a large chuck attached to the spindle of a knee-type milling machine. The grinder was mounted on the machine table so as to revolve



Set-up for grinding a large ball race

about the pivot *A*, which was a taper fit in the base *B*. The curvature of the races, as left by the lathe, was used as a guide to adjust the grinder to the proper radius.

In swinging the grinder, we found it necessary to interpose a link between the lever *C* and the hand of the operator, for the reason that when the lever was grasped in his hand, more or less downward pressure was exerted, causing irregularities in the grinding.

While many fears were indulged in regarding the final accuracy of the work, they were set at rest when the bearing was assembled and tested, at which time it was found the races were not more than 0.002 in. out of parallel.

The dimensions of the races were: Outside diameter, 19½ in. Inside diameter, 13½ in. Thickness 1¼ in. Balls 2½ in. in diameter were used.

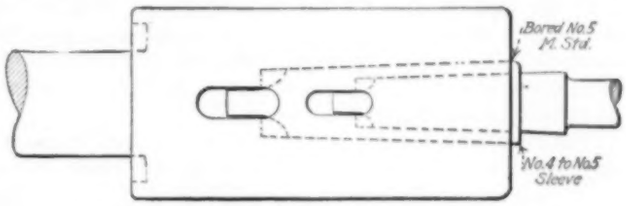
Improvement in Drill-Press Spindles

BY H. ELLSWORTH

It was a decided improvement in the construction of drilling machine spindles when the spindles were so designed that when they were all the way up, the drift slots came beneath the bearings and were available at all times.

Another improvement came by increasing the diameter of the spindle nose of the average size machine, so it could be bored to suit the No. 5 Morse standard taper instead of the No. 4, as originally made.

For some years we have had our spindles so made, with the further convenience of a second drift slot as



Drill press spindle with two drift slots

shown in the sketch. This second slot permits the use of a No. 5 drill sleeve, and since the general run of tools used have No. 4 taper shanks, the sleeve may remain in the spindle and the tools drifted out without disturbing it.

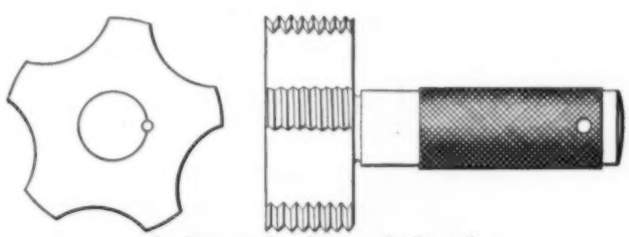
Sleeves being inexpensive, they serve a further purpose in protecting the bore of the spindle, the truth and condition of which should be preserved.

A Cleaner for Faceplate and Chuck Threads—Discussion

BY CHAS. DOESCHER

On page 630, Vol. 62, of the *American Machinist*, in an article under the title given above, Charles B. Park shows a cleaner for removing chips or grit from faceplate and chuck threads. While I agree with Mr. Park that his device will do "the trick" and can be used on a number of different sizes of threads, the fact remains that its use is altogether too slow, for the reason that when using it one must give it a part turn, then change his grip and continue doing so until the device has reached the end of the thread.

The cleaning tap illustrated herewith is easily and cheaply made, and makes an ideal type of inside thread cleaner, for it can be spun in and out by the knurled



A cleaner for internal threads

handle in less time than it takes to tell. It does a quick, thorough job and should be used with every lathe.

The writer at one time worked in a toolroom where the foreman insisted on having the cleaning tap spun in and out of the threads of the chuck or faceplate before they were screwed on the lathe spindle. This was a good idea, for it meant that if the rule was obeyed, no chuck would or could be forced on the lathe spindle, nor would any time be lost taking off a faceplate that would not screw up because a chip had lodged in the thread.

IDEAS FROM PRACTICAL MEN

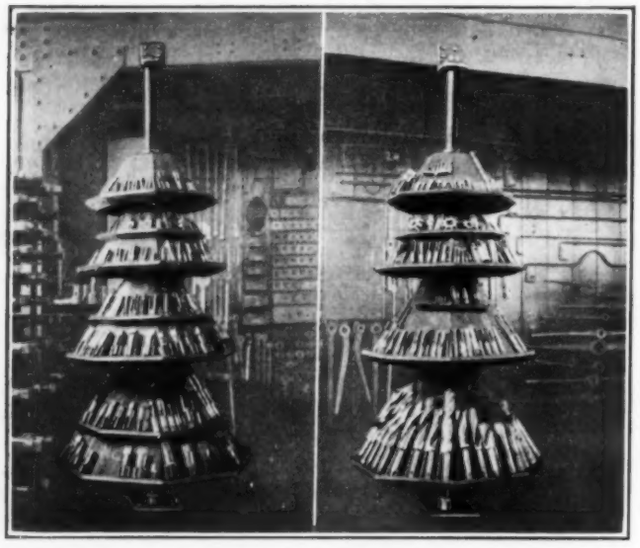
Revolving Tool Racks

By G. Charles Hoey

In the tool room of a railroad shop it is very desirable that all small tools, such as reamers, taps, dies, twist drills and wrenches, be placed in a position readily accessible to the tool window. The revolving tool rack satisfies this condition, as well as the further condition of requiring but small floor space.

The revolving tool racks illustrated are used in pairs, one on each side of, and back about five feet from, each tool room window.

Each rack occupies a floor space of less than 12 sq.ft. To remove any tool requires a maximum reach of 6 ft.



Convenient tool racks

Each rack consists of four units in the form of octagonal, truncated pyramids, supported by a vertical shaft made of 2-in. pipe.

The pipe is supported at the base by a ball thrust-bearing and at the top by an angle post bolted to the underside of the gallery. The upper bearing merely acts as a guide in case the rack should be unevenly loaded.

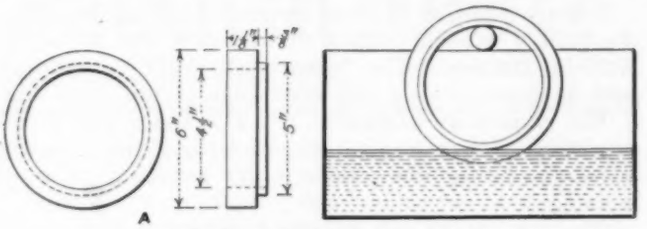
The wood faces of the different units are sub-divided by strips to accommodate several rows of small tools.

Reclaiming Oversize Rings by Shrinking

By Charles Kugler

Through the oversight of a lathe hand three rings like *A* in the accompanying sketch were bored too large by 0.007 in. and thus spoiled for the purpose for which they were intended, since they were to be a shrink fit on a shaft already turned. The workman responsible for the error very cleverly reduced the diameter of the rings 0.015 in. by the method here described and then rebored them to the required size.

The rings were heated, successively, and suspended as shown in the sketch from a round bar laid on the edges of a tank, in which the height of the water had previously been gaged so that it would cover only a portion



Method of shrinking the rings

of the lower side of the ring. By rolling the bar along the edge of the tank the entire circumference of the ring was cooled, causing it to contract and force the remaining heated metal toward the center.

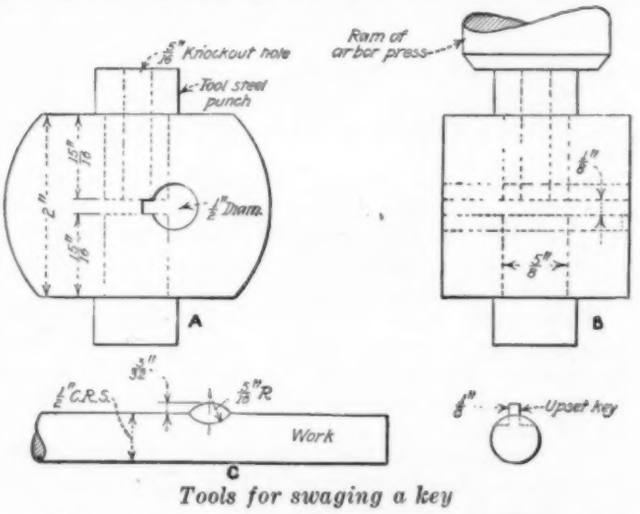
Swaging a Key on a Cold-Rolled Shaft

By H. L. Wheeler

The illustration shows how a solid, or swaged, key may be made on a small shaft of cold-rolled steel by means of a few simple and inexpensive tools. The only machine required is an arbor press.

The details of the die and punches may easily be picked out from the front and side elevations *A* and *B*, respectively, while at *C* is shown a ½-in. shaft with a key raised upon it. The tools are made of tool steel and hardened in the usual way. The upper punch is provided with a ⅛-in. knock-out hole for use in case either of the punches should stick in the die.

The stock is inserted in the transverse hole of the die and located to bring the key at the desired distance



Tools for swaging a key

from either end. The punches are then set into the die, and, holding the assembled job under the ram of an arbor press, one man can easily exert sufficient pressure upon the latter to swage, or upset, the key. The punches are made so that they will stop against their respective shoulders, and the central position of the key with relation to the stock is thus assured.

The shaft can then be driven out of the die and the operation repeated as often as desired. The whole operation should take no more than three minutes. Keys made in this way do not vary more than 0.001 in. in thickness.

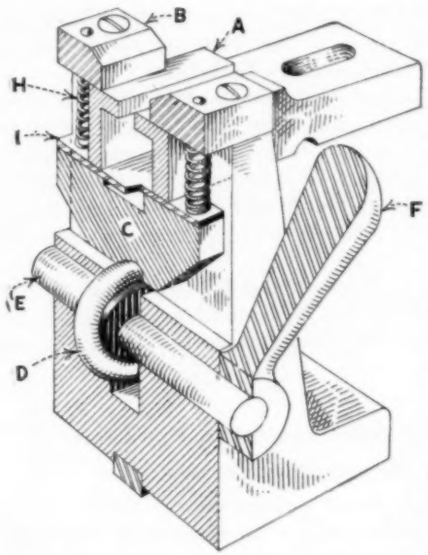
IDEAS FROM PRACTICAL MEN

A Cam-Operated Fixture

By M. H. Ames

In milling a slot through the upper part of a long slender casting, holding fixtures, one of which is shown in the illustration, were used. Since the slot had to be straight and of uniform width, it was necessary that the casting be clamped in several places along its length.

Accordingly a number of clamping units were attached at suitable distances along a base plate. The top surface *A* of the work, which had been finished in a previous operation, was held against the underside of the plates *B* by the equalizer *C*. The cam *D*, which is keyed to the shaft *E* and operated by the lever *F*, is simply an eccentric with the face rounded to fit a slot in the equalizer *C*. The equalizer is confined in one direction by a slot in the body of the fixture and in the other direction by the cam. The springs *H* insure that the equalizer will follow the releasing action of the cam and release the work when the position of the cam permits.



Clamping fixture operated by a cam

To facilitate loading, the light metal track *I* was provided and bridged all of the holding fixtures. It was light enough so that it did not interfere with the clamping and was a decided help in that it was not necessary to guide the work over each equalizer in turn.

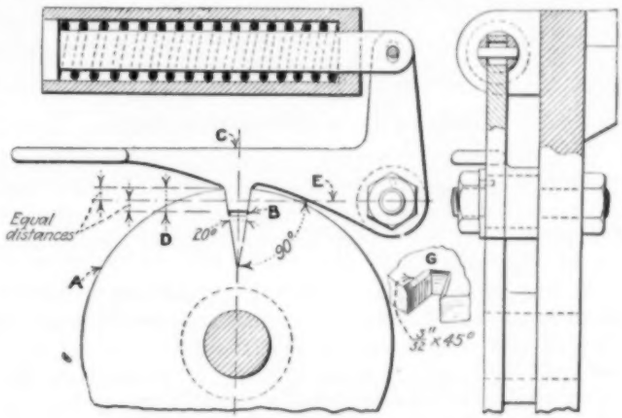
This fixture replaced one in which the equalizers were carried on a rod and were beveled at the bottom to an angle of about 45 deg. They were forced up by the pointed ends of screws turned to the same angle. Besides being much quicker to operate, the cam fixture can be made stronger without increase in bulk.

Indexing Mechanism for Jig and Fixture Work

By George Feltner

The illustration shows a method of locating an index plate for jig and fixture work and the correct proportions that should be followed to insure accuracy. A similar method is commonly used but it does not always work successfully, because the principle is often improperly applied.

The index plate *A* may have any number of notches *B*, which should have an included angle of 20 deg., as shown. This angle offers a positive lock, since it is great enough to prevent the locking lug from binding and small enough to avoid having it jar out of place. The engaging portion of the lever *C*, represented by the distance *D*, may be made to suit the size of the unit,



Indexing device for jigs and fixtures

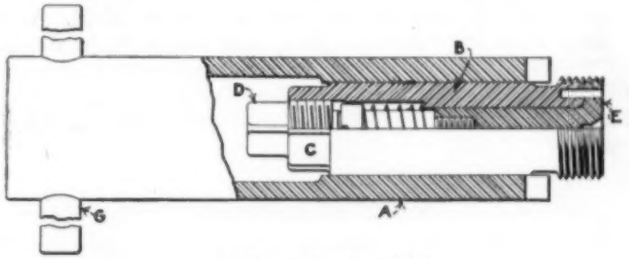
but the center line of the swinging point *E*, must be one half of the distance *D* in order to provide a solid bearing and a positive lock for the mechanism. A clearance of about 1/32 in. should be allowed between the end of the locking lug and the bottom of the notch, so that any dirt that may accumulate on either part will not prevent a full engagement. If the whole index plate abuts one of the surfaces of the fixture, it would be advisable to chamfer the sides of the notch adjacent thereto, as shown at *G*. This would aid in eliminating improper indexing, caused by dirt or sediment lodging in the notch.

A Hand-Operated Facing Tool

By Alfred T. Gregory

The illustration shows a facing tool for use on aluminum cylinder blocks. Its purpose is for facing the boss of the hole for the oil suction-pipe, square with the internal threads.

In operation, the cutter body *A* is first removed from the pilot *B*. The pilot is then screwed into the pipe hole in the block a convenient distance, using a wrench on the end *C*. Screw *D* is tightened, forcing the threaded



A hand facing tool

plug *E* outwardly and thus aligning the pilot accurately with the threads in the hole. The cutter body is then put over the pilot, on which it is a slip fit, and by turning the handle *G*, the cutting teeth at the end will face the surface of the boss square with the threads in the hole.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Roller-Chain Drive Layout

Q. I have seen a number of roller-chain drives where there is a whipping action of the chain. Can you tell me what may be the cause and what the remedy is? Please also give me briefly the general rules for the best layout of a roller-chain drive.

A. The probable cause of this condition, providing there are no rapid and uniform fluctuations of the power taken by the driven unit, is that the drive has not been designed with an integral number of pitches on the pitch circles of the sprockets between the points of tangency of the chain. Since the true pitch line of a sprocket is a polygon, and not a circle, the distance of the center line of the chain to the center of the sprocket varies during the passage of each tooth. This causes a rising and falling action on a horizontal drive at the point of tangency on the sprockets.

Thus when the action is outwards from the center on one sprocket and inwards on the other the tendency to whip will occur. The polygon effect decreases as the number of teeth are increased and is an explanation of the fact that sprockets with the fewer number of teeth may be undesirable at high speeds.

The following brief general rules hold for the lay-out of roller-chain drives:

1. Roller chains may be run at any angle but must be arranged with adequate take-up provision on vertical and nearly vertical drives.

2. The slack strand should be on the bottom of a horizontal drive with short center distances, but is not so important a factor as the length is increased.

3. Idler sprockets are not recommended but, if they must be used, should be designed as carefully as either of the main sprockets on the drive. They should never be set on the tight side or made to run at greater speeds than are recommended for the main sprockets.

Further data and additional rules are available in the engineering hand books. These data appear on pages 1317 to 1322 in the tenth edition of Kent. We believe it is best practice in laying out a chain drive to submit the detail data to the engineering service departments of the chain manufacturers which are maintained for the purpose of rendering expert advice.

Design of a Broach

Q. Are there any rules upon which we can depend in designing broaches, and can you refer us to a text-book on the subject? Please also give us your opinion on how much metal we can expect to remove with each successive tooth of a pull-broach in steel, cast iron and brass.

A. There are no rules or formulas that can be followed blindly as there are a number of variables affecting each given piece of work, such as the material to be cut, the length of the work, its shape, and the amount of stock to be removed.

There is a good book on the subject called Broaches and Broaching written by Ethan Viall and published by the McGraw-Hill Book Co., New York City.

The amount of metal that can be removed on mild steel in medium-size holes may vary from 0.001 to 0.003 in. In cast iron and brass, if the piece is fairly heavy, twice this amount is practical. On holes above 2 in. in diameter, where the broach will stand up under the pull, as much as 0.005 to 0.010 in. can be removed with each cutter.

In this connection it should be kept in mind that if the cut is small there will be a tendency of the teeth to drag and become dull more rapidly than if a heavier cut is taken.

Drill Press Attachment to Produce a Hexagonal Form

Q. I have tried to locate an attachment which can be used on a drill press for machining an outside hexagonal form on the end of a cylindrical piece. I am under the impression that I have heard of, or seen, one but am unable to place it now. Perhaps you can help me.

A. We have no record of such an attachment and there is none advertised but perhaps our readers can be of assistance to enlighten us both on the matter. We understand that you are not interested in other ways of doing the work.

Using a Coolant in Grinding High-Speed Drills

Q. Some of the men in the shop maintain that high-speed tools in general should be ground dry. Others hold that water should be at hand for cooling the points as they tend to get hot. Please let us have your opinion.

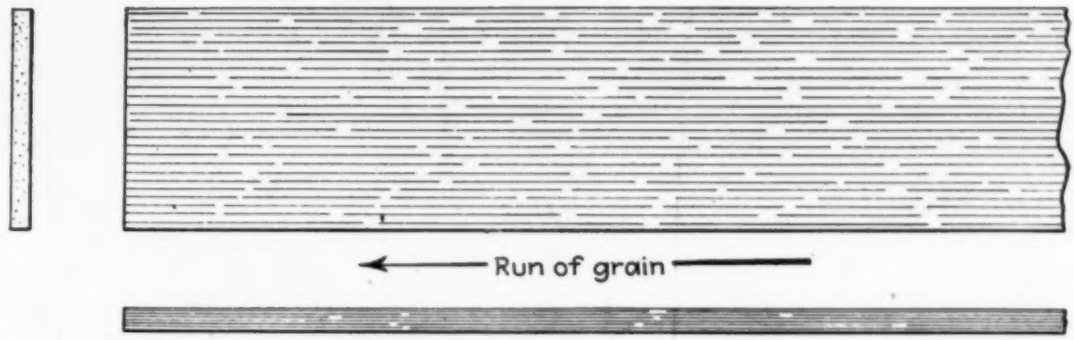
A. Care is necessary in grinding dry not to burn the point, although in high-speed steel the temperature can be run quite high before this will occur. Care, in the case of wet grinding, is even more necessary to make certain that the point or thin cutting edge does not get dry for an instant. It will heat up at once and the next water that hits this hot point will be almost certain to cause checking. Under no condition should a drill or tool be ground dry and then be dipped into water or any other cooling medium.

There is in fact greater danger of checking a high-speed tool when wet grinding it than there is of burning it in dry grinding which makes this latter method preferable as a general rule.

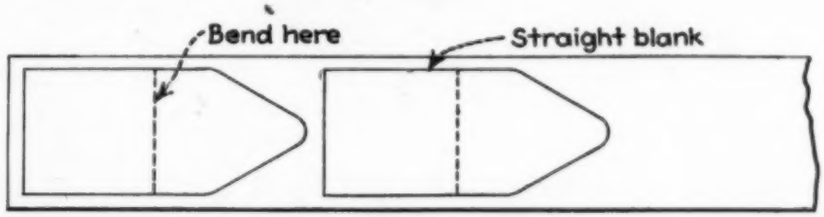
It can be added that dressing the wheel at close enough intervals, to keep the working surface from glazing over, will go a long way toward obviating the danger of overheating and burning.

Punch here to suit your binder

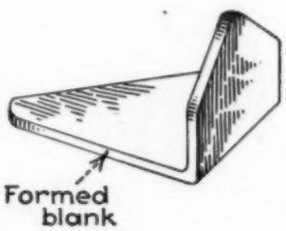
Rules for Laying Out Bending Dies

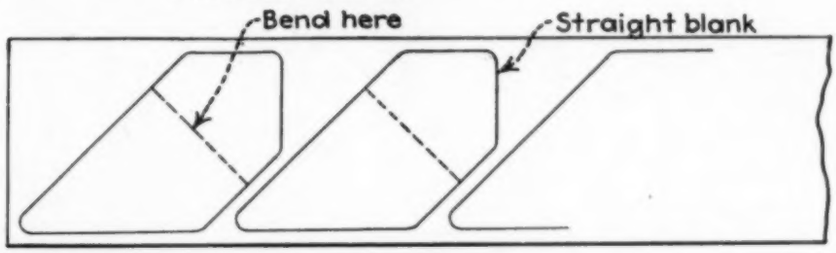


Blanks that are to be formed with a bend of 90 deg., should be laid out so that the bend will come as near as possible against the grain of the metal to insure against breaking while bending. These rules apply for sharp bends only. The grain of sheet metal always runs lengthwise

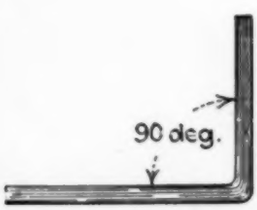


Layout with bend at right angle to grain is the best method

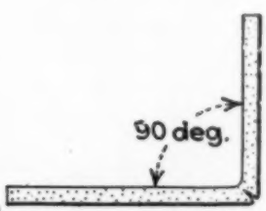




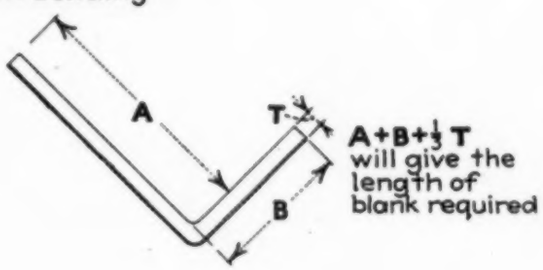
Layout with bend 45 deg. with grain will seldom break in bending



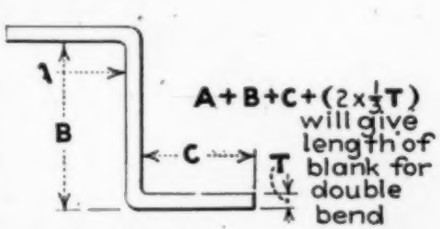
Work bent against grain, forming a correct bend



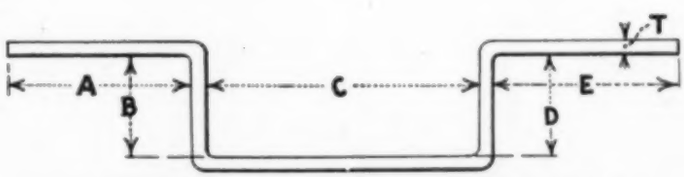
Work bent with grain, causing break at bend



Single Bend



Double Bend



Multiple Bend

Punch here to suit your binder
Trim Line

Technical Abstracts

British Unemployment Problems

In July, 1924, the estimated number of persons employed under the National Health-Insurance Act in Great Britain was 11,514,000; the number of unemployed on April 27, 1925 was 1,292,130 or a percentage, therefore, of unemployed of 11.2. In the steel industry there were over 55,000 unemployed; in engineering and ship building there were over 80,000 unemployed in each industry. Mass unemployment is confined to a number of industries relatively, although by no means actually small in magnitude. There is a very heavy burden of unemployment in a certain number of industries, a more moderate one in a large number, and relatively a normal rate of unemployment in the bulk of the industries classified.

The one bright spot in this gloomy picture is that since the war the population of Great Britain has increased 4,000,000, so that with even these high figures the country is employing 3,000,000 more people than before the war but the rate of increase and development is insufficient to deal with the increasing population. Sir Alfred Mond, who contributes this paper, states that one of the chief things that is keeping apart the seller and the buyer today is the cost of production. If this cost can be reduced, a larger volume of business will follow and Sir Alfred asks whether a practical scheme cannot be devised by which this gulf can be bridged. Among the methods he suggests are new and improved systems of output, organization of administration and management, revision of the system of taxation, the importance of research and invention, and greater and fuller co-partnership between all those engaged in industry.

Some information is given concerning the effect of the so-called "dole" or bonus to those unemployed, it being pointed out that there will be difficulty in getting people who have had the "dole" to come back to full industrial efficiency when the nation wants them. Sir Alfred then outlines a scheme to obtain work for those now receiving out-of-work benefit. The basis of this system is part-time employment.—*Journal of the Royal Society of Arts*, July 10, p. 775.

Psychology and the Conveyor System

Prof. Ing. E. Sachsenberg in a lecture before the annual meeting of the Verein deutscher Ingenieure points out the necessity of the proper selection of workers for operations at continuously moving conveyors. His observations in America led him to conclude that this element was being completely neglected. One can, however, be sure that in Germany the psychology of the average worker would strongly militate against the continuously moving conveyor. It is only by selecting the rather exceptional individuals for such work that one can hope for success. Very likely the work would be helped along by introducing a certain artificial rythm by means of light or bell signals. In determining the rythm, the question of fatigue would have to be carefully considered.—*Zeitschrift des Vereines deutscher Ingenieure*, May 9, p. 658.

Arc Welding

This article describes the work of the Lincoln Electric Co., Cleveland, Ohio, in using arc welding in their own business. The number of welding operations described, that this company is doing in the construction of motors, may be taken to indicate what the welding process offers to manufacturers of other lines of equipment.

The frame or end rings of the motors, that formerly were cast are now made of standard angle sections. The angle is cut to length and heated red hot, placed on a bending fixture, rolled into a circle and the two ends then welded together. The ventilating ducts are made with a punch press. Angles of various sizes up to 3x5 in. are used. This steel ring is much stronger than the cast-iron ring and it is also stated that cast-iron rings require a cross-section two and a half times greater than those of steel, thus cutting down the air passages within the motor. The motor frames are made of angle and flat-bar sections welded together to complete the structure. The wheels are made of steel disks and rims. The rims are rolled in a hoop and the ends welded. The disks are next welded to the rims. The hubs of the wheels are made of pipe welded into the wheels and fitted with roller bearings.—*Iron Age*, July 9, p. 70.

A German Machine-Tool Monthly

One of the articles in this journal contains a very extended discussion of modern electric drives for horizontal boring mills and milling machines. Complete half-tone views, mechanical details and electrical wiring diagrams are given, and the machines covered seem at least in the main to be the product of the Schiess Machine Works of Duesseldorf. There follows an article on modern drop forging and upsetting with numerous die and tool sketches. Next is a description of a screw thread micrometer developed by the well-known firm, Carl Zeiss, of Jena. It has interchangeable points, so that one device is suitable for a great variety of screw threads. It also has points for the measurement of ball races and for measuring fairly soft substances.

A very convenient belt tightener manufactured by the Humbolt Machine Works in Cologne, Kalk, is described and illustrated. This device uses spring tension instead of counter weights and can be set up and adjusted in a multiplicity of positions. There is a device for drilling the holes for round keys in composite crankshafts; a short article on fixtures; one on an electrically driven wood working machine for drilling, slotting, and notching; another on a device for grinding stopcocks; a note on an eight-spindle horizontal drilling machine; a note on rubber bearings; and finally the usual market reports.—*Die Werzeugmaschine*, May 30, 1925.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Economy in Machine Drives

THE swing toward individual motor drive for all kinds of mechanical appliances, from machine tools to rolling mills, has developed such an amplitude that in many cases it has resulted in inefficiency and lack of economy that is very evident on the books of the enterprise. There is no question but that individual motor drive has distinct advantages in flexibility of machine arrangement, freedom from overhead works and moving belts, better lighting, less dust, etc., but like all such advantages the cost may be too high to be warranted.

What the manager of a plant must decide is whether or not these advantages more than offset the extra cost, for it is often true that individual motors are run intermittently and at less than rated capacity, with the result that the power factor of the whole plant is low. If power is purchased from a utility company a low power factor generally means a stiff penalty charge.

Surplus Shipping and Surplus Machine Tools

IT HAS been stated in a release to the press by William Francis Gibbs, president of the firm of Gibbs Bros., that the surplus ships, left over from war time, "are essentially junk from an economic standpoint in the light of present and future shipping needs. . . ."

There is an analogy between this statement concerning obsolete ships and prevailing conditions as regards obsolete machine tools in many plants. The only difference is that the ships are lying idle while the machine tools are quite likely to be at work.

It is no exaggeration, if by borrowing Mr. Gibbs' expression and making certain substitutions in it, we make it read that these obsolete machine tools "are essentially junk from an economic standpoint in the light of present and future manufacturing needs."

One Way to Bring About Standardization

THERE are various ways of encouraging people to adopt standard practices and standardized commodities. The way taken by the Union of Soviet Socialist Republics looks effective even though it sounds autocratic and will probably be unpopular. According to a recently passed resolution certain sizes of motor vehicle tires are declared standard and no others may be imported. Tires of other sizes may be manufactured in Russia so long as old vehicles in use require them. Vehicles with wheels that require non-standard tires may not be imported, nor may they be manufactured in Russia.

It may be quite possible to enforce such a ruling in an autocratically governed country but an attempt to do so in the United States would encounter determined opposition.

In some ways this ruling is not unlike the one that the metric advocates would like to have saddled on industry and commerce by Congress. As remarked above it may be feasible in Russia but would be unenforceable here.

Have You a Landing Field?

FOR several years we've been pointing out the fact that landing fields were a necessity to any town or city that wanted to encourage aviation. Just as good roads and tourist camps attract travelers so will a good landing field help put a city on the route of air travel. Cities spend millions on docks to attract ocean transport. A few thousands will put a city on the air map.

While the development of air transport has been less rapid than we had hoped, it has nevertheless made real progress. The remarkable reliability shown by the consistent performance of the Air Mail has done much to impress us with the possibility of commercial air service. Then, too, the Ford line from Detroit to Chicago, and the launching of the new National Transport Co. with such splendid backing, have given great impetus to the new mode of travel.

If your city or town has not already made preparation for one or more good landing fields, it is high time it did. Get the best advice obtainable as to its location and layout, as a poor field will soon get a bad reputation for the city and will be money wasted. Get a good landing field and get it now.

Just Suppose—

JUST suppose that you decide to buy a brand new printing press, or motor generator set, or ice cream machine. You sign the order and in due time the machine arrives, brave in its new paint and shining brass work. You pay for it and feel very well satisfied with yourself and your purchase until something goes wrong and you find out that the machine is actually several years old, has seen hard service and has only been doctored up with paint and polishing to take you in.

Such things seldom happen any more? Well, perhaps not often, but wouldn't it be better if they never did?

Just suppose

Shop Equipment News

Doelger & Kirsten Crushing Feeder and Double-Blade Alligator Shear

The crushing feeder and the double-blade alligator shear are both developments that have been put on the market by the Doelger & Kirsten Co., 3017 Chambers St., Milwaukee, Wis. The equipment is intended for handling and cutting scrap tubing and pipe to conserve space and facilitate handling.

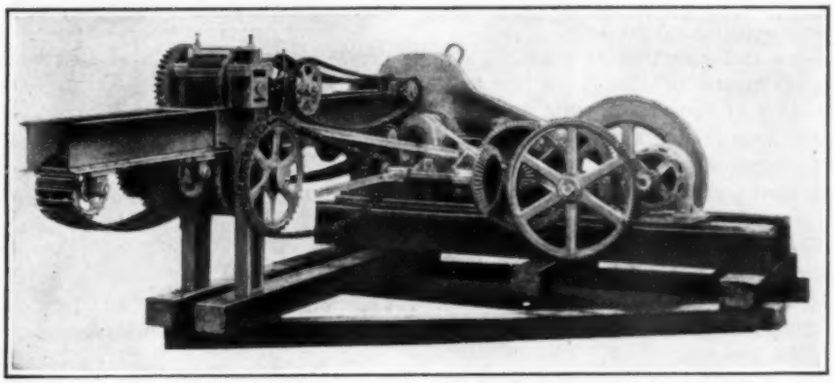


Fig. 1—Doelger & Kirsten Crushing Feeder and Double-Blade Alligator Shear

The crushing feeder, illustrated in Fig. 1, is designed with a capacity sufficient for handling only light tubing, but it can be increased in strength, as occasion demands, to automatically crush and feed heavier gages of pipe.

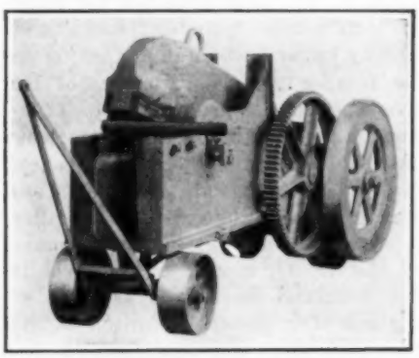


Fig. 2—The front of a portable double-blade machine

The material is placed on the belt conveyor shown at the left, from where it is drawn in between the crushing rolls. These rolls, one above the other, are adjustable and are backed up by heavy springs to compensate for uneven thicknesses of the material as fed. Beyond the rolls, and between them and the shear, two belt conveyors are set one over the other to hold and to feed the flattened pipe under the shear jaws.

The crusher feed is driven by gears and chains to its component parts from a bevel gear mounted on the end of the crankshaft of the shear proper.

In Fig. 2 is shown one of the double-blade shears mounted on a truck for transportation to various points of use. The particular machine illustrated is intended for light work, but can be built for any desired capacity. It is said that the double-knife construction more than doubles the quantity capacity of the machine.

The portable double-blade shear may be had either with belt or electric motor drive. Mounted on the same shaft that carries a heavy flywheel there is a small pinion, reducing the original speed to a rate that is suitable for this type of shear.

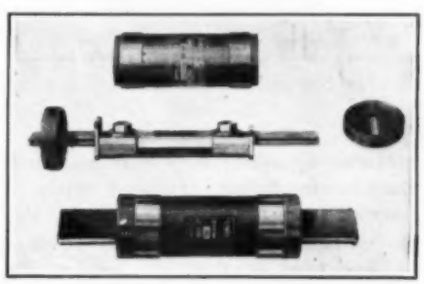
The general construction of the machine conforms with the company's line as pertains to the drive bearing construction and take-up arrangement on the main bearing. The difference is that there are two blade alignment guides, one on each side of the upper jaw, and the front end of the frame and the jaw itself have been made to take the double set of knives. These knives are adjustable and can be turned to present four cutting edges before they have to be reground.

Union Renewable Knife-Blade Fuse

The design of the Union renewable knife-blade fuse, made by the Chicago Fuse Manufacturing Co., Laflin and 15th Sts., Chicago, Ill., has been simplified, and the model illustrated put on the market.

It consists of two principal members, a fiber case with threaded brass ends, and the removable bar assembly that carries the replace link. The bar is held by two brass caps that screw on the ends of the case, through which it passes.

As the illustration shows, the link is clamped to the supporting bridge at both ends by two small screws, and by loosening these screws, the blown fuse parts may be replaced with new links. The supporting bridge consists of two sections of flat copper, constituting the knife blades, connected by a strip of rigid fiber. To prevent the bursting of the fiber case, small vents are provided at each end, which allow the escape of the gases.



Union Renewable Knife-Blade Fuse

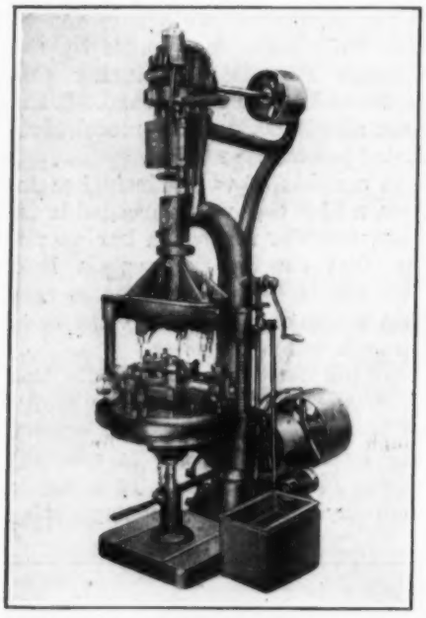
The fuses are made for use on circuits of 250 or 600 volts and with ratings from 65 to 600 amperes.

SHOP EQUIPMENT NEWS

Hoefer Special Drilling and Tapping Machine

The special drilling and tapping machine illustrated has been built by the Hoefer Manufacturing Co., Freeport, Ill., for special application to the drilling and tapping of a hole in the shank of a universal joint fork. It represents one of the variety of applications for which the company stands ready to make combinations of its standard lines of drill heads and reverse gear tappers, together with special features needed to meet a given set of conditions.

The unit consists of a standard 23-in. Hoefer drill head with a standard 2 to 1 reverse gear tapper on a



Hoefer Special Drilling and Tapping Machine

vertical spindle, the regular feed mechanism being replaced with a special feed to meet the work requirements.

This feed is positive, advancing the head at a rate to conform with the 27 threads per inch on the taps. Due to the fact that this lead could not be attained direct on the spindle on account of the limited size of the small-pitch threads, a gear reduction was installed. A gear that is fast to the spindle and located just below the tapper assembly drives a pair of gears mounted on a backshaft arrangement parallel to the spindle. A fourth gear, which is mounted on the spindle which has a 9-pitch thread, is driven from these back gears at a speed ratio with reference to the first spindle gear of 1 to 3. This results in the desired spindle lead on sufficiently coarse-pitch threads.

The drills in the head are driven at a speed to give the correct relation between the r.p.m. and the feed per revolution based on the feed used in tapping. The drill spindles are provided with special collets with vertical adjustment to compensate for drill grinding. The tapping spindles are adjustable from the outside of the head by means of setscrews which back them up. These two spindles also are allowed a small amount of end-play to avoid a possible jamming of the taps.

Feed and direction of rotation are set by means of the hand lever at the start of the cycle, while an automatic trip reverse is arranged to stop further advance at a predetermined travel limit and to back the tap out of the work.

The work table is designed to hold three sets of parts and to have three stations, one for drilling, one for tapping and one at the front for loading and unloading. The rotation between stations is accomplished by hand after releasing a foot-controlled locating pin.

Kempsmith Production Hand Miller

The production hand miller manufactured by the Kempsmith Manufacturing Co., Milwaukee, Wis., is a single-purpose machine and is intended for splitting piston rings, for milling keyseats and flats, for slotting screws and for similar work.

The drive is from a motor or clutch pulley which can be mounted on a bracket extended from the column. A 2-hp., 1,200-r.p.m. motor is recommended, but one of variable speed can be furnished if desired.

The drive shaft terminates in a steel worm which meshes with a bronze wormwheel on the cutter spindle. Worm and wormwheel run in oil.

The table is moved by means of a lever to a gear and rack and has a travel of 5 in. Its 5½x10½-in. upper surface is designed to hold small fixtures. The knee is stationary and integral with the upper-column section.

The hollow spindle, which is fitted

Kempsmith Production Hand Miller

with a No. 9 B.&S. taper hole for holding the tools, stands 5½ in. above the table and rotates at 300 r.p.m. as the standard speed. The hole through the spindle measures 1⅛ in. The main spindle bearing is 2⅛ in. in diameter by 3⅛ in. in length.

The machine stands 47 in. in height and weighs 580 lb. net.

Rockwell Hardness-Testing Machine, Model D. U.

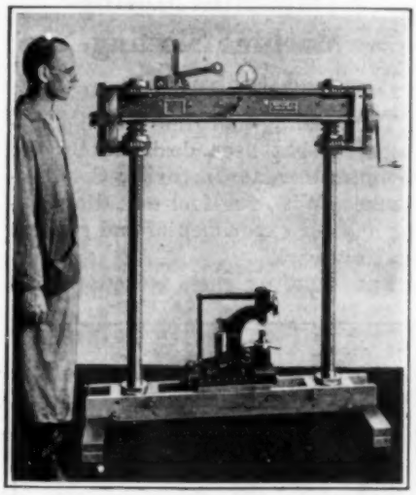
The model D. U. testing machine has been added to its other sizes of similar equipment by the Wilson-Maeulin Co., 383 Concord Ave., New York, N. Y. It is intended for work on automobile cylinder blocks and similar parts beyond the capacity of the smaller models. An idea of its size and the comparative construction of parts, other than the testing unit which is duplicated in all sizes, can be obtained from the illustration which shows one of the smaller type-A machines resting on the base of the D. U. model. This base is not regularly furnished as part of the machine, which is limited to the two columns and the bridge assembly, but is constructed by the purchaser to suit given working conditions.

Two sets of gears mounted on either end of the bridge are connected to move the table up and down by operating the hand crank at one end, which actuates two units on each column through worms to a wormwheel mounted on each nut. Helical springs below the bridge

SHOP EQUIPMENT NEWS

bear on the lower nuts to hold the bridge up against the upper nuts causing them to bear up against the under side of the column threads. The purpose of this construction is to eliminate any lost motion due to losseness on the columns when the load is applied.

The penetrator is pressed against the work with an initial or "minor" load, as it is called, of 10 kilograms.



Rockwell Hardness Testing Machine, Model D. U.

After this load is set, the dial mounted at the center of the bridge is made to read zero and then the major load is applied and removed. Finally the reading is taken with the minor load still imposed.

In the standard size of the model D. U. the effective vertical gap is 20 in. and there is a clearance of 25 in. between the columns. These dimensions however are subject to change on specification.

South Bend Woodworker Model A 25

The Model A 25 woodworker, incorporating a suction fan to collect sawdust, is being manufactured by the Koontz Brothers Electric Co., South Bend, Indiana. It is intended for cross-cut and rip sawing in general pattern shop work, but an attachment is made for use in connection with the machine to hold carbon blocks to be bevelled into V-type or rectangular motor or generator brushes.

Two legs of the pedestal are equipped with casters so that, by lifting the opposite side, the machine may be wheeled into any location desired. A ¾-hp., 60-cycle, single-phase, repulsion-type motor, controlled by a snap switch, is mounted on this pedestal and equipped with 25 ft. of flexible cord so it may be connected to any lamp socket using 110- or 220-volt current.

The exhaust fan is mounted directly on the outer end of the motor shaft and supported from one side of the pedestal. The funnel of the fan housing, in which the lower half of the saw rotates, serves also as a support for the table, which is provided with hinges to permit lowering or raising it to cut grooves and to facilitate the changing of saws. Setscrews on the hinges make it possible to square and level the table.

The saw turns on a ball bearing arbor that is driven by a 2-in. belt from a pulley on the motor shaft between the fan and the motor housing. An idler pulley, mounted on a bracket extending from the fan housing, can be adjusted to tighten the belt, by means of a setscrew turning against a bracket which is

South Bend Woodworker Model A 25

bolted to the top of the pedestal. One side of the dust-collecting bag is also supported from the pedestal, while the other is hung from the exhaust outlet of the fan.

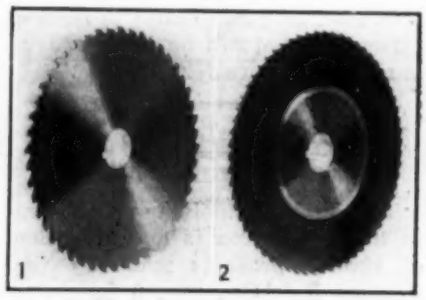
The machine, equipped with a 14½- x 22½-in. table, stands 35 in. high The diameter of the saw is 8 in., allowing a maximum depth of cut of 2 in., and the speed is 2,800 revolutions per minute.

A 1⅛-in. and a 1¾-in. carborundum wheel is provided with the outfit in addition to a rip and cutoff saw. These dimensions apply also to the wheels that are used in connection with the work on brush beveling, their diameters being the same as the saws which are provided.

National Formed-Tooth Metal-Slitting Saws

Two of the designs of metal-slitting saws that have been developed by the National Twist Drill & Tool Co., 6522 Brush St., Detroit, Mich., are illustrated. One is intended for use on soft metal and the other for drop-forged steel parts.

The type designed for slitting



Figs. 1 and 2—National Formed-Tooth, Metal-Slitting Saws

such metals as copper, brass and bronze is illustrated in Fig. 1, while its profile is shown in the line drawing, Fig. 3 at *B*. The connecting-

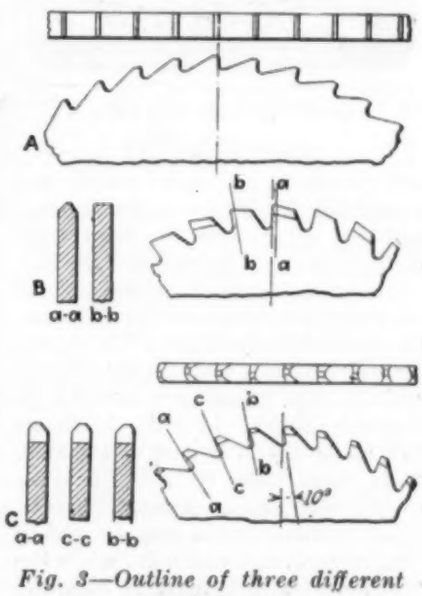


Fig. 3—Outline of three different tooth forms

SHOP EQUIPMENT NEWS

rod type, designed for use on drop-forged steel parts, is illustrated in Fig. 2, and its profile and section are given in Fig. 3 at *C*. In Fig. 3 at *A* is a section of the usual saw.

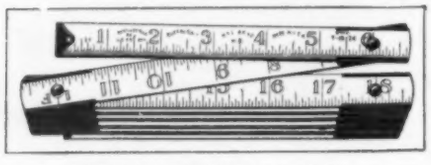
The formed-tooth slitting saw shown in Fig. 1 has teeth that are cut radial and sides which are ground concave. Every alternate tooth has a 45 deg. bevel on each side, as shown at *a-a* in Fig. 2 *B*, while the other teeth are plain, as shown at *b-b* in the illustration.

The connecting-rod type, Fig. 2, has teeth that are undercut between 7 and 10 deg. of rake angle, and with sides ground concave.

The cross-section at Fig. 3*C* shows the staggered effect produced on the teeth *a-a* and *b-b*, which both have 45-deg. bevels. Tooth *c-c* is ground with equal 45-deg. bevels on each side. A large radius is formed between each tooth on both models, to allow clearance for chips.

Rustless Rule Co., Inc. Aluminum Rule

The rustless aluminum rule shown in the illustration is one of a line of similar products made by the Rustless Rule Co., Inc., 9 Lafayette Ave., Buffalo, N. Y. It is manufactured in two models, the regular English rule and the English vest-pocket rule, consisting of 6-in. and 4-in. sections respectively. The two



Rustless Rule Co., Inc., Aluminum Rule

end sections of each model are graduated in 32nds while the remainder is marked in 16ths with black, embossed figures and lines.

The material used in this rule is a spring aluminum alloy to insure lightness with flexibility. The joints are of spring brass fitting on the section ends which are tapered to improve the fit. In order to facilitate opening and closing of the rule, there are two common bearing rather than an all-bearing surface.

The regular model may be had in lengths of 3, 4, 5 and 6 ft., while the vest pocket rule is made in 2-ft. and 3-ft. sizes.

Kane & Roach Core-Wire Straightening Machine No. D

The core-wire straightening machine illustrated is being built by the Kane & Roach Co., Syracuse, N. Y., for use particularly in foundry cleaning rooms for salvaging core wire in varying short lengths. It is claimed that it will straighten 95 per cent of the wire by passing

Kane & Roach Core-Wire Straightening Machine, No. D

it once through the machine, even though, as fed, it may be badly bent and twisted. Its capacity is 150 to 200 ft. per minute for wire ranging in diameter between $\frac{1}{16}$ and $\frac{3}{8}$ inches.

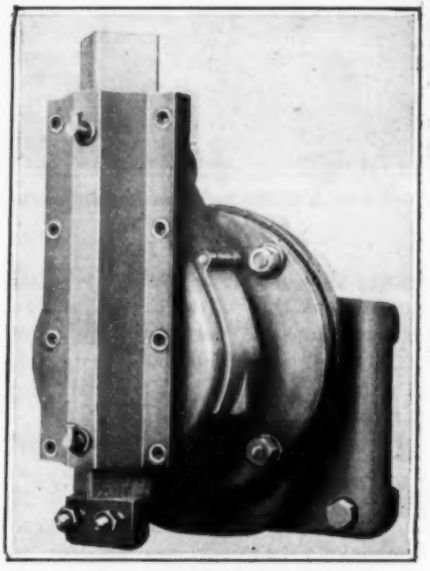
The wire is fed through a heat-treated and hardened guide to the first pair of four sets of straightening rolls, which are made of tool steel also heat-treated and hardened. The first two rolls act as feed rolls to force the wire through the others, which are staggered. They can be adjusted by turning an adjusting screw located in the upper frame of the machine. The upper rolls of the staggered sets are backed up by springs to prevent turning the drive shafts. All of the rolls but one are gear-driven from a 2-hp. motor which can be located under the base in an inverted position, or by countershaft to a pair of pulleys in place of the motor should this arrangement be desired. The drive shafts, made of high carbon steel, polished, measure $1\frac{3}{4}$ in. in diameter.

The passes in the rolls are cut so that when the machine has been adjusted it will operate regardless of the size of wire within its range by raising or lowering the last roll. This adjustment is said to correct any tendency of the straightened wire to tend upwards or downwards as it emerges from the machine.

Kempsmith Milling-Machine Slotting Attachment

The milling-machine slotting attachment has been designed by the Kempsmith Manufacturing Co., Milwaukee, Wis., for tool and die making and for experimental and general slotting work.

The slide, or ram, is square and



Kempsmith Milling-Machine Slotting Attachment

operates in straight V-guides. It is made hollow to provide a large bearing surface with light weight and also to insure fine-grained dense metal for the bearing surfaces. All bearing adjustments are made with the cap, no gibs being used.

The ram is driven by a bronze-bushed driving link to a slotted crank disk, which provides for changing the length of stroke, the range being from 0 to 4 in. The crankshaft is driven by a spur gear mounted on the company's patented spindle nose.

The ram is arranged with a clamp at its end to accommodate any shape of tool shank.

News of the Week

Metal-Working Industries in France Suffer from Economic Ailments

Agricultural machinery shows increased demand

The metal manufacturing trades in France stagnate during the summer months. The present year is no exception. There is a visible activity in government, political and financial circles, but treating as they do of the ultimate economic aspect of things there is little developing to encourage the stabilizing of production or trade.

This is the more apparent by reason of the uncertainties of the financial program which bespeaks the gold loan projected by the Painlevé-Caillaux ministry, to say nothing of new taxation which is going to hit big industrial concerns and workers and private individuals still harder. The Franco-German accord is entering into a deadlock stage and all "pourparlers" are put off for further discussion until autumn.

In the meantime the Moroccan campaign is doing nothing to clarify the situation, and if there is no rampant Bolshevism visible in France the spirit of unrest is apparent on all hands. The Moroccan warfare is primarily the disturbing element and until that is settled and the question of the American debt at least ironed out and simplified as to how and when it is going to be paid, there will be little encouragement for the French business man to believe that he is soon to get his rightful place in the sun. The interval is one which will require keen finance to carry over.

The automobile trade is a good indication of general conditions. Production is light, costs are high and gasoline charges for the user are mounting steadily, in spite of the fact that when the dollar was less costly paid for in francs, gasoline was from two to three francs the gallon cheaper than at present.

It is hoped that the unrest in the Belgian metal trades will not reach France. Wages are higher in France and work has been more steady, it is true, but psychologically considered this latter may be due to the fact that the French workman's output is less than that of many of his foreign confrères. On this basis his job lasts longer.

The eight-hour day is still something more than a bogey in the economic adjustment of things. France is perhaps less concerned than many other European countries, but the fact is that there is an undercurrent of resentment here for what is believed an advantage on the part of the German and Belgian manufacturer who in many cases has a wholesome disregard for this policy. When the French 44-hour week is compared with from 57 to 60 hours in many districts of Germany, the comparison with France is only the more apparent.

French railways are working at a disadvantage because with an increase in operating labor, fares and freights have risen to take care of this additional labor required. With mines and manufacturing plants the same is true. If French prices, when reduced to dollars still seem ridiculously cheap when compared with American prices, they are not cheap to the French consumer.

Agriculture Shows Life

If there is any machinery activity to be noted it is with respect to agricultural tools and machinery chiefly. Gasoline motors are increasing in small and big industries and to a lesser extent on the farms. Electrical machinery of all kinds is also popular but the real electrification of France, in spite of the ambitious program announced, is far in the future. France imported considerably less in bulk of agricultural machinery during the first four months of the year. Exports of like material were somewhat less than a third of that figure for the same period.

Tool and machinery makers in general are overstocked and it is hardly conceivable that they will go on piling up stocks merely for the problematic sale on rush orders at some remote future date. The general financial situation is tightening credits in these lines as in many others. Machine tool imports, largely from the United States and Germany, showed an increase of 15 per cent for the first four months of this year, over the same period last year. As dollar exchange rose something like three francs during the period, this carries with it heavy charges which are probably warranted by the superiority of the material imported over that which was available from home manufacturers.

France Paying Herself

Germany's demands on France, though the negotiations are now broken off until the fall, are a minimum tariff for German manufacturers in the form of finished products in exchange for the free entry of French pig iron and semi-finished products into Germany. If the situation appears to be one sided, which perhaps accounts for the difficulties of coming to an understanding, it must be remembered that Germany is encouraged to make this demand by the necessity of showing profits which will enable her to pay the Dawes plan annuities to France. As the French economists believe it looks as though France would be paying her own annuities.

If the Moroccan warfare takes an untoward turn and Abdel Krim succeeds in getting adherents to his policies in the French protectorate, France will lose a very profitable market. France sold to Morocco last year tools and machinery to the value of twenty million francs, and automobiles to the extent of seventeen million francs. Total French exports for the year 1924 to Morocco were valued at 259 million francs.

Little Activity in Mechanical Branches of British Engineering Industries

Automotive and electrical manufacturers fairly busy

The condition of engineering in Great Britain remains unsatisfactory, with no immediate prospect of improvement. Labor dissatisfaction is evident, and troubles of this sort threaten in other directions. There are, of course, one or two bright spots; the motor car industry and the electrical engineering trades are generally prosperous. Employment in both these branches promises to be well maintained for some time.

The production of automobiles may have slackened somewhat, but this would be purely a seasonal result. Perhaps because of the weather, the demand certainly continued much longer than had been anticipated. Overtime and even night work in the shops has not been uncommon, and some firms are considering means for increasing production. The firm with the largest output will in the course of a few months be in a position to produce 2,000 cars a week, and the machine tool industry has benefited already from that fact. The home demand for motor cars has increased, while imports in the last few months have certainly not slackened. There was a rush to avoid the new duties now imposed.

The commercial vehicle industry, which suffered in the past owing to the large surplus left over from the war period, has steadily improved its position. Makers of motor cycles have

been well employed, and this is also true of the ordinary pedal cycle.

Agricultural engineers are in a better position, and some firms are fairly busy. The railways, both at home and abroad, have provided orders for wagons and rolling stock and tenders have been made to meet further requirements overseas. The boot and shoe industry appears to be improving, and before long this may show itself in connection with machinery required. Textile machinists are slacker, the demand for home replacements that was anticipated some time ago having failed to manifest itself.

In the Sheffield district renewal orders have been obtained for railway material, etc., but while a few orders have been received by the machine tool trade, that branch of engineering has not been heavily called upon of late on behalf of the railway companies, who, it is thought, have been economizing in this direction. Still, a few orders have been received.

Machine tool firms report that orders obtained are of a miscellaneous character, without indicating a special call from any particular branch of engineering. Makers of small tools have little complaint, and file makers in particular have been busier and some have been working full time. All the same, prices are not satisfactory. It has been stated that few makers of small tools are making profits.

Machinery Exports for June

Exports of metal-working machinery for June, with revised comparative figures for June, 1924, as compiled by the Department of Commerce, are as follows:

	June, 1924	June, 1925
Lathes	$94,133	$177,483
Boring and drilling machines	34,018	36,183
Planers, shapers and slotters	27,364	87,795
Bending and power presses	24,192	52,723
Gear-cutting machines	33,332	59,414
Milling machines	70,028	115,145
Thread-cutting and screw machines	30,437	103,075
Punching and shearing machines	4,956	11,543
Power hammers	26,342	63,303
External grinding machines	130,362	114,197
Internal grinding machines	72,242	40,622
Other grinding and sharpening machines	35,884	42,717
Chucks for machine tools	27,531	27,847
Reamers, cutters, drills, taps, dies and other metal-working tools	147,635	260,659
Pneumatic portable tools	95,704	71,278
Foundry and molding equipment	63,031	49,863
Other metal-working machinery, and parts of	472,920	454,655
Metal-working machine tools Total	$1,390,111	$1,768,502

Must Resubmit Patents to Soviet Authorities

It is reported that the Soviet authorities have notified foreign inventors and patentees that under the new patent law adopted last fall patents issued and registered in Russia under the old regime, or applied for prior to Nov. 7, 1918, should be resubmitted to the Inventions Committee, 76 Fontanka, Leningrad, for renewal. It is understood that applications for renewals may be made up to Sept. 25, 1925, and should be submitted through some representative residing in Russia.

Experiments on Air Brakes at Purdue University

A check for $10,000, part of a sum of nearly $100,000 that is to be expended by the American Railway Association, at Purdue University, Lafayette, Ind., for experimental work on air brakes, has been received by Dean A. A. Potter, director of the engineering experiment station. A similar sum was received some time ago to inaugurate the experiments.

The work is progressing rapidly, according to Dean Potter, and much time is being devoted to the installation of some $20,000 worth of machinery and equipment. It is planned to hold a preliminary track test for a 100-car train early in September, and prominent railroad men from all over the United States will be invited to witness the test.

Ford Bid Wins Contest for Scrap Ships

The Shipping Board on Aug. 4, accepted the $1,706,000 cash bid of Henry Ford for 200 steel vessels to be scrapped. The next highest bid, $1,370,000, made by the Boston Iron and Metal Co., of Baltimore, which was rejected in June, included the right to resell engines and boilers which was not permitted in the terms of Mr. Ford's offer.

The decision of the board to accept the Ford offer was reached after a long session, during which the respective merits of the various bids was carefully considered. Those voting in favor of it were Chairman O'Conner and Commissioners Lissner, Haney and Hill. Commissioner Benson cast the negative ballot.

Bethlehem Executives Out

The resignations of three prominent executives of the Bethlehem Steel Corporation who have been with the company for several years, and who have risen to positions of prominence in the steel industry, were announced last week. The resignations become effective September first.

One of the three whose resignations were announced was Archibald Johnston, vice-president of the company, who played a prominent part in building up the organization when it was pressed to make speedy deliveries of munitions and other materials during the war. Mr. Johnston for a long time has been looked upon in the steel industry as one of Charles M. Schwab's closest associates.

Another to resign was H. S. Snyder, vice-president of the company in charge of its finances. The third resignation was that of William M. Tobias, general manager.

The resignations, coming simultaneously, caused considerable surprise in financial and steel trade circles. The real reason for the resignations, according to statements by representatives of the company, was that they were in line with the company's economy program, necessitated by the small profits in the steel industry at the present time because of the low level of selling prices.

In addition to Mr. Schwab, who is chairman of the board of directors, and E. G. Grace, who is president, the company has two other vice-presidents who will continue to serve the company under the new arrangement. They are J. H. Ward and H. E. Lewis, the latter being right-hand man to President Grace.

Railroads Paid Highest Taxes in 1924

Taxes paid in 1924 by Class I railroads to the Federal and State governments were the greatest for any year in history, amounting to $340,342,067, according to tabulations just completed and made public by the Bureau of Railway Economics.

This was an increase of $8,426,608, or 2.5 per cent, over the amount paid in 1923. The average daily tax bill of the railroads in 1924 amounted to $929,896. Out of each hundred dollars of operating revenue obtained by the railroads during that year $5.80 went for tax purposes.

New York State ranked first in the amount of taxes received from railroads, the rail carriers in that state paying $22,102,534. Illinois ranked second with $20,043,496; Ohio third with $18,723,966; New Jersey fourth with $16,946,127; California fifth with $12,854,397.

Urgent Need for Development of Manganese Materials

Intensive research on manganese-bearing materials is regarded as one of the most urgent needs of the war mineral situation. The aggregate of manganese in the United States is large, but it occurs in such forms that profitable recovery by present methods is possible only at a few points when prices are normal.

The problem has come in for extended study during the past ten years and there is a very general feeling that it is not insurmountable. If the results which have been obtained in laboratories can be translated successfully into commercial practice, some of our present resources can be used to great advantage.

The recent war revealed just how weak we are in the matter of manganese. While the need of manganese for use in connection with the national defense has been the incentive behind most of the research that has been done, its promising character now is giving rise to a demand that greater efforts be put forth to make this resource available for commercial use.

French Tax on Trademarks

The new finance law which was voted recently by the French parliament, provides for an additional state tax of 50 frances to be paid the state on the deposit of a trademark. This is in addition to the regular fees and another 10 francs to the National Office of Industrial Property. The law went into effect immediately.

Plans Complete for Machine Tool Exhibit

Plans are being rapidly completed for the annual machine tool exhibit to be held at the Mason Laboratory, Sheffield Scientific School of Yale University, in New Haven, Sept. 8 to 11. At this exhibit the latest developments in the machine tool industry will be demonstrated by showing the machines in actual production work. Practically all of the exhibits actually will be producing commercial material during the four days, and for this reason the exhibition should prove very interesting to works managers, superintendents, foremen, and even skilled mechanics. Also, the educational atmosphere in which it is held brings it to the attention of undergraduate engineering students.

The technical side of the development of machine tools and machine shop practice is adequately presented in technical meetings arranged by the Machine Shop Practice Division of the American Society of Mechanical Engineers. The executive committee of this division includes W. F. Dixon, works manager of the Singer Manufacturing Co., and vice-president of the Diehl Manufacturing Co., who is chairman; Carl L. Bausch, superintendent of the Bausch & Lomb Optical Co.; J. H. Connolly, general manager of the Standard Machinery Co.; E. S. Patch, with Moraine Products Co., a division of the General Motors Research Corporation; W. J. Peets, in charge of factory methods, Singer Manufacturing Co.; and J. A. Smith, general superintendent of the General Electric Co. at Schenectady.

The general committee in charge of the arrangements has been working intensively since last November, and already has practically all of the large volume of details completed. The personnel of this committee is under the direction of H. R. Westcott.

Already there has been a sufficient number of responses to the committee's invitations to warrant the assurance that this will be one of the most successful convention exhibits ever planned by the society.

Railway Foremen Meet in Chicago Next Month

The American Railway Tool Foremen's Association will hold its thirteenth annual convention at the Hotel Sherman, Chicago, Sept. 2, 3 and 4. This association is composed of machine shop and tool foremen who have adopted for their motto "Higher Efficiancy in the Railway Tool Service." The president of the association is Charles Helm, of the C. M. & St. P. Ry., and the secretary is G. G. Macina, also of the C. M. & St. P. Ry.

Quite an unusual and interesting program has been arranged. The opening address will be made by H. T. Bentley, general superintendent of motive power for the C. & N. W. G. T. Martin assistant to the general superintendent of motive power of the C. M. & St. P., will talk on "The Tool Foremen's Responsibilities," and E. L. Woodward, associate editor of the *Mechanical Engineer*, will talk on "The Importance of the Toolroom to the Railroads."

Papers have been prepared by various committees on the following topics: Standardization of tools in locomotive and car shops; Grinding in the railroad shops; Jigs and devices for the locomotive and car shops; Forging machine dies; Machine tool equipment for the toolroom; Economies possible by standardized small tools.

In addition, these exhibits of modern machine tools and hand tools will be displayed through the courtesy of the Railway Supply Association, the details of which are being handled by H. K. Clark, secretary, of 51 West Water St., Milwaukee, Wisconsin.

Industrial and Mechanical Problems Feature Safety Congress Program

The program for the sectional meetings of the metals section of the National Safety Council at the fourteenth annual safety congress, to be held in Cleveland, Ohio, Sept. 28 to Oct. 2, has been announced by the officers of the section.

Sessions will be held on Tuesday, Wednesday and Thursday. The program for the first session will consist of a symposium of fundamentals of industrial safety education presented from three important viewpoints. The fundamentals upon which a company must work will be discussed by M. E. Danford, works manager, American Rolling Mill Co., Middletown, Ohio. The important problem of personal contact between the company and the man will be the subject of the address by Phillip Stremmel, assistant general superintendent, National Enameling and Stamping Co., Granite City, Ill. The third phase of the problem, the steel worker and his characteristics, will be presented by Arthur T. Morey, general manager, Commonwealth Steel Co., Granite City, Ill.

Mechanical Problems

The second session will be devoted to a discussion of mechanical problems. J. A. Hughes, superintendent of transportation and labor, Duquesne Works, Carnegie Steel Co., will discuss the safe transportation of steel products, with reference to plant railways, locomotive cranes, tractors, and yard trucks, also the element of personal supervision and intelligent operation. W. F. Ames, McClintic-Marshall Co., Braddock, Pa., will present a paper on safe methods used in fabrication of steel, dealing with the laying out, cutting, shaping, refining, assembling, storage and shipping of steel for structural purposes. Other speakers will discuss the subject of "hot metal and how to handle it safely," and "safety achievements of the industry."

The third session will be devoted to a round-table conference around the general topic "Observation the Greatest Safety Instructor." Accompanying the discussion will be an exhibition of stereopticon slides illustrating many valuable safety devices that have been developed in the industry during the past year.

Program for Steel Treaters' Meeting

The committee of arrangements for the seventh annual convention and steel exposition of the American Society for Steel Treating and the National Steel Exposition has just announced the program for the coming event which will take all of the week of September 14. The convention will be held this year in Cleveland, where the Hotel Cleveland will take care of morning sessions and the Hollenden Hotel will house the afternoon sessions. The steel exposition which will include demonstrations of steel making and treating, operation of machine tools and other interesting processes, will be held in the Cleveland Public Auditorium. At the present writing eighty-nine manufacturers of machine tools and small tools and equipment have reserved exhibition space at the show, and eighty-three manufacturers will exhibit metals, metal working, treating and testing apparatus, and inspection equipment.

Technical Papers

The list of papers to be presented at the technical sessions include:

"Effect of Cold-Work on Endurance and Other Properties of Metals," D. J. McAdam, Jr.; "What Happens When Metal Fails by Fatigue," Prof. H. F. Moore; "Oil Burning Equipment for Industrial Furnaces," W. H. Mawhinney; "Effect of Reheat on Cold Drawn Bars," S. C. Spalding; "Welding Steel Tubing and Sheet with Chrome Molybdenum Welding Wire," F. T. Sisco and H. W. Boulton; "Graphitization of Constant Temperature," H. A. Schwartz; "Dimensional Changes on Tempering and Aging Tool Steel," Howard Scott; "Report Relating to the Effect of Mass on the Quenching of Steels," H. J. French; "Comparative Slow-Bend and Impact Notched Bar Tests on Some Metals," S. N. Petrenko; "Why Cast Iron and Steel Cracks and Warps," John F. Keller; "Rates and Diffusion of Metals," D. J. Demorest; "On the Nature of Certain Low-Tungsten Tool Steels," M. A. Grossmann; "The Toughness of Hardened Steel," R. S. Archer; "The Chemical Composition of Tool Steels," J. P. Gill; "An Experimental Investigation of Effects of Overheating on the Physical Properties of Certain Alloy Forging Steels," Lieutenants Duell and Franks, U. S. Army; "Carburization by Solid Cements," W. E. Day, Jr.; "Irregular Carburization—Its Causes and Preventions," W. J. Merten; "Alloy Steels for Engineering Purpose," B. D. Saklatwalla, and H. T. Chandler; "Magnet Steels," J R. Adams.

There will also be a symposium on hardness testing under the direction of the National Research Council, a conference on metallurgical education, a production meeting under the auspices of the Society of Automotive Engineers and a session on machine shop practice conducted by the American Society of Mechanical Engineers.

J. B. Dillard, of the Cleveland Twist Drill Co., is general chairman of the convention committee.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

ONE of the most interesting phases of crowd psychology is the phenomenon of land speculation. It has been observable in Florida for some time, but it is now working northward and has finally struck New York. Last week, at Rockaway Park, Long Island, a real estate boom came suddenly into being, and in a few days property values were advanced many hundred per cent. Concurrently, the F. W. Dodge Corporation has issued a statement showing that last month's construction contracts reached the highest July total on record, amounting to $529,000,100 for 36 states. This figure shows an increase over July of last year of more than 53 per cent. There may be something to the contention that the last stage of an inflating movement appears in the form of building and land speculation.

In any event, interest in the activity of the Stock Exchange appears to be waning. In spite of strenuous efforts to push values upward, the stock market seems to be threshing around wildly without getting anywhere. Perhaps the public is still smarting too much from the decline of last spring to be drawn in at the present time. The shares which lend themselves to manipulation are bid up, but many of them slip back; bonds are distinctly easier, and the demand for real investments seems to be on the wane. Money is also higher and the Federal Reserve statement shows a perceptible expansion of credit for the first time in several weeks. The bills discounted have increased by $75,000,000, the gold held shows a reduction of $22,000,000 and the reserve ratio has declined from 77.3 to 75.3 per cent.

Per contra, the Bank of England has increased its reserve ratio to 31 per cent and reduced its rate from 5 to 4½ per cent. The lowering of the rate is generally construed as a concession to the British inflationists, but it ought to help British trade also. Some think that the gold holdings of our Federal Reserve Banks have been drawn upon to strengthen the position of the Bank of England.

These are but straws, but their direction is more definite than it was last week, and they sustain the conservatives who are advising profit-taking and caution.

But the record of the business that has passed and the trend of commodity prices are still encouraging. Car loadings again showed an increase during the week, exceeding by 18,633 cars the high record of the preceding week. Recent earning statements indicate that the railroads, as a whole, are doing exceedingly well. President Coolidge has unofficially announced himself as being anxious to do anything in his power to facilitate the railroad consolidations now pending.

Reports from the iron and steel industry are cheerful. The *Iron Age* announces that the tide has turned in pig iron production and that August will probably see the first production increase in several months. Quotations have already stiffened, and in the eastern Pennsylvania district one company has marked up its asking price 50 cents to base of $21 a ton for No. 2 foundry grade. The activity in steel also appears to be gaining. The operations of the U. S. Steel subsidiaries last week were just under 70 per cent capacity compared with 68 per cent for the previous week and 61 per cent a month ago. On the other hand, a wage cut of 10 per cent has been announced by a large eastern Pennsylvania steel mill.

The strongest copper market since the war was indicated by an advance in the price for that metal to 14¾ cents a pound for western deliveries. Concerted buying by domestic consumers, a stronger European inquiry, and an oversold condition of producers were given as reasons for this rise. Rubber prices continued to sag throughout the week, ribbed smoked sheets for August reaching 83 cents, approximately 40 cents under the recent high.

The anthracite coal conference has adjourned sine die without coming to any agreement and the threatened coal strike looms closer. The general opinion, however, is that if the strike does come it will be of short duration and of little industrial consequence to the nation.

As this is written the cotton market awaits the Government crop estimate that will probably determine its course for the next fortnight. Were it not for the factitious influence of these reports, prices would probably be lower, for the crop seems to be doing well everywhere except in the drought-stricken area of Texas. The uncertainty concerning the price of the raw material is reflected in the cotton goods market, where hand-to-mouth buying is again the rule, and the same thing is true of woolen and worsted textiles.

The news from Europe is not especially significant. Premier Baldwin is being severely criticized for the policy followed in settling the coal controversy. France is still optimistic over the stabilization of her currency and the sale of the gold parity bonds. According to authentic reports American trade with Russia broke all post-war records during the first six months of 1925. Further reports indicate that Russian wheat exports, long anticipated, will be a real factor in the world markets this season.

Viewed synthetically the outlook is in the main satisfactory, but it will be well to remember that we cannot continue to advance prices here without imperilling our domestic market.

What's Doing in Industry

With the first half of August about over, hasty estimates place the volume of machine tool business as on a par with the same period in the month of July. The momentum that was attained in the last two weeks of last month has not showed any signs of abatement, and dealers and agents in the machinery industry are quite optimistic over the prospects for a profitable total of summer business.

A noticeable feature of the present market is the fact that price competition has become less important. Quick and efficient service has been made necessary by the natural reaction of hand-to-mouth buying, and dealers who can give service are getting most of the business.

Railroads continue to buy, New York and Cincinnati both reporting an increase of business from that source. In Detroit the automotive industry is still furnishing a fair amount of new orders, the expansion of plants and the introduction of new models affording additional sources of sales of machine tools and shop equipment.

Buffalo has shown signs of awakening, new inquiries being reported in that section. New England also reports a better condition, with automotive accessory and electrical manufacturers in the market for machinery. Canada admits an outlook for better business than it had last month, with unusual activity in all of the metal-working markets.

The business outlook in the main is satisfactory and unless advancing prices and a distention of the stock market go beyond reason, there is no cause for apprehension.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

Business is spotty and hand-to-mouth buying continues to prevail. This sums up conditions in the machinery industry in sections of New England. The automotive trade is buying in fair quantities. Machinery requirements as a whole are judged to be replacement business.

Substantial business came into sections of Connecticut last week from the automobile trade, especially from parts manufacturers. The manner in which this business has opened up offers much encouragement. It is interesting to note that a General Motors subsidiary in this section is now employing a working force as large as at any time during the war period and is operating on the same working schedule.

Opinions are general that the Middlewest is offering the best trade and buying by exporters is increasing. Special machine builders report trade is dull at this time.

Canada

Present business and industrial conditions in Canada are favorable to the machinery and machine-tool trade. An upward trend has developed in the metal markets generally, in spite of dullness consequent to summer holidays and mid-year inventories.

Automotive plants are enlarging operations as both domestic and export business improves. Inquiry among manufacturers in central Canada reveals the fact that sales during the first six months of the year were good. General Motors of Canada, with large assembly plants at Oshawa, Ontario, reports domestic sales the largest in the history of the company. Prediction of a bumper crop in Western Canada is bringing business for agricultural implement plants. The car shops are also busy in preparation for handling the coming harvest.

Business is being secured in the mining regions by machinery supply and steel warehouse firms. During the last week a large order for mining equipment was placed in Toronto by the Cobalt Contact Mines.

Buffalo

The last half of July marked a slight improvement in the Buffalo district, according to reports from machinery dealers and manufacturers' agents. The first half of the month was quiet but the improvement in the last half brought the volume of business up equal with that of June. There are indications that August will show another slight increase, but nothing of a startling nature is anticipated until September.

Railroads are doing no buying in the local market and none is expected until later.

The demand for electrical equipment is fair, somewhat under that of earlier in the year, but the present condition is considered purely seasonal. No large equipment is being sold but quite a large amount of small equipment has moved and the demand in this line is rather steady.

The demand for road builders' and contractors' equipment showed an unexpected improvement during late July. This was partly due to the fact that several contracts for large building jobs were let late in the month. The list includes some industrial construction, additions to factories and the like, which indicates that there will be some machinery sales in the same direction when the construction is completed.

One machinery dealer reported July best in sales volume since January 1, but added that the demand was chiefly for standard equipment in tools for machine shops—shapers, drill presses and the like. Individual orders were comparatively small.

One dealer reported that he had done more business in June and July than in the previous four months of the year. But he admitted that this was no criterion for general conditions and that most of the contracts were the developmet of efforts of earlier months. Most of the equipment went out of town. It included one big drilling machine, two big lathes, several good-sized drill presses, including fifteen in one place, and two boring mills.

Cincinnati

A slight increase in the demand for machine tools in the past week is reported by the majority of Cincinnati manufacturers. Practically all plants are working full time, but working forces are reduced and production is less than maximum. Local selling agencies report better conditions, with an increased number of inquiries.

Railroads made more purchases in the past week than in the one that preceded it, but they still continue to buy in small quantities and for replacements that cannot be avoided. Lists of requirements and requests for quotations from this source have increased, however.

The automotive industries placed a few orders in the past week, and it is judged from the inquiries coming in that larger purchases are contemplated by concerns in this line, especially from builders of motor buses and trucks.

No tendency toward localization of trade is noticeable, orders and inquiries being evenly distributed over all sections of the country, with large and small machines in approximately equal demand. A few export orders are reported, with a fair number of inquiries for special machines. The visit of a German manufacturer of locomotives to machine tool manufacturers here this week will, it is hoped, result in some orders.

Detroit

Sales of machinery and machine tools in the Detroit district continue at practically the same level that they have maintained for some weeks, with an increase in inquiries for smaller tools quite noticeable.

Announcement of new models on the part of leaders in the automotive field has brought increased demand for new machinery, and the striving for greater production at less cost has resulted in a call for speedier machines.

Whether Hudson-Essex, Page-Jewett, Studebaker, Gray, General Motors Truck and Chrysler will follow the lead of Ford, Dodge and Packard in spending millions for better equipment remains to be seen. If production is increased materially without extensive purchases of new equipment, the day of reckoning when new machinery must be purchased will be hastened.

The Hudson Motor Car Co. appears to be on the verge of taking a revolutionary step in the automotive field. A number of departments are now working on a seven-day basis, and it is not unlikely that the whole factory will go on a seven-day basis before long. The tremendous expense of additions and changes in equipment necessary if greater production is to be obtained with present machinery has forced Hudson executives to decide upon a seven-day week instead of the usual six-day week.

Activities throughout the state continue to give promise of steady sales of machinery and tools in all sections. Employment in Detroit automobile factories has reached 242,511, the highest number ever known in the city's history.

Indianapolis

Machinery and tool sales in this territory, while considerably spotted, show no material decline from the volume of two weeks ago. Some lines appear to be entirely out of the market, but others not only are buying a little more heavily, but are making numerous inquiries.

The automobile trade is slow. Most of the factories here have curtailed production and it will probably be late fall before any activity is resumed. Demand for tools and machinery continues good, however, from the accessory manufacturers.

Demand for special machinery for furniture factories is increasing, and the volume of inquiries from this source also increases. Railroad business shows a little increase, but the volume is not yet what it should be. Executives here believe that if business continues to increase during the fall the repair and replacement programs will be altered to provide for more machinery and tool sales. Demand from the farm implement factories shows a slight decline from two weeks ago.

New York

The first week in August has not revealed any noticeable slowing up in sales of machine tools in the local market. Contrary to expectations—which were based on past records—business has kept up a rather steady pace, and practically every dealer and manufacturer's agent reports increased sales.

Railroad business leads in the present market. Inquiries that were sent out earlier in the year are beginning to materialize in the way of actual orders. Industrials are also active buyers, many large expansions necessitating the equipment of new shops.

The following are a few of the sales recorded during the past week, indicating the trend of buying: The Baldwin Locomotive Works, a 5-ton, 46-ft. span crane; the Atlantic Coast Line Railroad, a 7½-ton, 60-ft., span crane; the New York Central Railroad, a 48-in., 500-ton hydraulic wheel press; the Essex County Vocational School, in New Jersey, two 13-in. toolroom lathes; the Westinghouse Electric and Manufacturing Co., three hand-screw machines.

One large industrial syndicate placed orders in the past few days for two centerless grinding machines, ten lathes and several drilling machines and presses.

One thing that characterizes the present market is the fact that quick and efficient service has taken the place of price competition. Buying being on a hand-to-mouth basis, the dealer or agent who can supply a wanted item with the least possible delay usually gets the order. Buyers wait until absolute necessity compels them to secure new tools or shop equipment, and then they want service more than price.

First Electric Locomotive for Ford's Railroad Ready for Trials

Unusual features promise interesting developments

The first electric locomotive for Henry Ford's Detroit, Toledo & Ironton Railroad has been completed at the Highland Park Ford plant, and will be given its initial tests on the 14 miles of electrified road between Detroit and Flat Rock.

The locomotive is built in two sections, is 117 ft. long and has 32 driving wheels each equipped with axle-hung motors. The engine will develop 5,000 hp. at 17 miles an hour, and will exert a maximum starting traction of 225,000 lb. on the basis of an axle loading of 42,500 lb. at 33½ per cent adhesion. The normal rating of the locomotive will be 4,200 horsepower.

A feature of the engine is that it contains its own substation for converting an alternating current to direct current for the motors.

The motor-generator set consists of one 1,500-kw., d.c. generator driven at 750 r.p.m. by a 2,100-hp. a.c. motor. The trolley voltage of 22,000 v. will be transformed.

In order that the locomotive may be operated over connecting 11,000-v. lines, if desired at some future date, the high voltage side of the transformer is connected so that it may be adjusted to operate on either 22,000 or 11,000 volts.

The company has announced that a railroad classification yard will be established at Flat Rock some time in the future, which will handle 8,000 cars. If tests on the 14-mile stretch prove as successful as anticipated, the entire line between Detroit and Ironton will undoubtedly be electrified.

The construction and placement of the reinforced concrete arches along the line represent departures from methods heretofore used. These arches support the overhead system, from which the locomotive by means of a pantagraph will collect the single-phase a.c. power at 22,000 v. This will be conducted through an oil circuit breaker to the primary side of the transformer, where it will be stepped down to the voltage for the motor on the motor-generator set.

There are 356 concrete arches on the electrified portion of the road. These were manufactured at a special plant at River Rouge and were put in place at the rate of from four to six a day.

Scholarship in Gas Engineering

Two scholarships in gas engineering in Johns Hopkins University have been offered by the Consolidated Gas, Electric Light & Power Co., according to a recent announcement. The scholarships are open to residents of Baltimore and vicinity who can meet the university requirements for entrance. Applicants may qualify for admission by graduation from an approved high school, or by examination to be held Sept. 14 to 17.

The appointments to these scholarships will be for one scholastic year. The holders will be eligible for reappointment from year to year if they conform in character, industry and ability with the standards and requirements of the university.

Protest Contract Work by Government Shops

A large number of protests have been filed lately by private concerns who bid on Government work, only to find that they were denied the contract because it subsequently was decided that the work contemplated should be performed at Navy Yards or Arsenals. These private concerns are communicating their protests to members of Congress, and a storm is likely to result during the next session. Senator Warren is very much opposed to the employment of Government plants in the production of material that should be acquired from private concerns after public advertisement that insures fair competition among producers.

The Navy recently issue a statement to the effect that Navy Yards would not be asked to submit estimates in rivalry with regular bidders unless there is some reason for supposing that the Yard plants are in a position to produce the articles wanted more economically. Since the issuance of this statement, instances of the cause of the protests multiply instead of decrease.

It is asserted by many of the contractors that orders have been placed at Navy Yards after secret estimates were made. The suppression by the Navy Department of bids and bid data is certain to become the subject of a Congressional discussion during the next Congress.

Business Paper Advertising Eligible for Bok Prizes

The committee in charge of the Harvard Advertising Awards, founded in 1923 by Edward W. Bok, has issued a statement calling to the attention of industrial advertisers and those using business and trade papers that advertisements or advertising campaigns appearing in the business press are eligible for consideration under the terms of the awards for 1925.

According to the committee, inquiries from some industrial advertisers indicated that they were uncertain whether their campaigns and advertisements were eligible. While no special awards have been provided for industrial or trade advertising as contrasted with consumer advertising, the industrial advertisements and campaigns are eligible to complete under the classification of awards as set up. According to the committee, the jury will be instructed to consider campaigns and advertisements with especial attention upon the problem which the advertiser faces and the skill and ingenuity with which the advertiser has met his problem. For the current year advertising published during the period from October 1, 1924, to January 1, 1926, is eligible for consideration. Submittal to the Harvard Business School, however, must be made by December 31, 1925.

Business Items

The Consolidated Machine Tool Corporation of America, announces from its main office in Rochester, N. Y., the following changes in the personnel of its branch offices: A. W. Watkins has resigned as manager of the New York office, and N. P. Lloyd has resigned as manager of the Philadelphia office. Robert L. Arms has been transferred from the Philadelphia to the New York office as manager and George F. Muth has been transferred from the Rochester engineering department to the Philadelphia office where he will act as sales engineer.

The Uehling Instrument Co., of Paterson, N. J., announces the appointment of two new sales representatives in the Southern territory. John C. Candler will cover Georgia, eastern Tennessee and part of South Carolina. Charles M. Setzer will cover North Carolina and the northern half of South Carolina.

The Spaulding Fiber Co., of Tonawanda, N. Y., has added new sales branch offices in Detroit, Cleveland and Cincinnati.

The Pitts Foundry Co., Inc., has been organized and incorporated at Birmingham, Ala., and will specialize in the manufacture of grey iron castings up to 4,000 lb. Alton V. Pitts, formerly general superintendent of the Kent Machine Co., of Kent, Ohio, is president and treasurer of the corporation. Other officers are: G. Johnson, formerly of the Miller Improved Gas Engine Co., of Springfield, Ohio, vice-president and superintendent; A. W. Jones, of Birmingham, secretary. The company has leased the factory property formerly occupied by the American-Blakeslee Manufacturing Co., in Birmingham.

The Stout Metal Airplane Co., of Detroit, has been sold to the Ford Motor Co. It is reported that the Ford organization plans the manufacture of metal planes on a large scale.

The Fisher Body Corporation has taken over from the General Motor Corporation the plant of the Buick Motor Co., in Detroit, and will convert it immediateley into a motor bus body manufacturing plant. The plant site has 40 acres and the building 500,000 sq.ft. of floor space. Expansion of the plant is proposed and it is stated that employment will be given thousands of men.

The Hershey Metal Products Co., a newly organized corporation has taken over the former Acme Tool and Machine Co. plant at Derby, Conn. Paul H. Hershey, formerly of the Liberty Tool and Machine Co., is the principal owner.

Equipment and patents of the Weldless Rolled Ring Co., of Cleveland, have been purchased by the Transue & Williams Steel Forging Corporation, of Alliance, Ohio. The former company will be moved to Alliance and will become a department of the Transue & Williams business.

The plant of the E. Stebbins Brass Manufacturing Co., Springfield, Mass., consisting of about 33,000 sq.ft. of factory floor space and 40,000 ft. of land, has been purchased by the Moore Drop Forging Co., whose shops are adjacent. Part of the machinery and equipment went to the Moore company, along with the real estate.

The Roller-Smith Co., 233 Broadway, New York, announces the appointment of the Tennessee Engineering and Sales Co., 510 Burwell Bldg., Knoxville, Tenn., as its agent in that part of Tennessee and Kentucky within a working radius of the city of Knoxville.

The Ampco Twist Drill and Tool Co., formerly of Detroit, has been consolidated with the Ampco Twist Drill Co., of Jackson, Mich. The property of the Detroit company will be moved to Jackson.

The Walworth Manufacturing Co., of Boston, has purchased the plant and properties of the National Pipe and Foundry Co., of Attalla, Ala., and has organized the Walworth Alabama Co. to conduct a local manufacturing business.

Personals

CLARENCE F. MERRIAM has been appointed manager of the St. Louis office of the Graton & Knight Manufacturing Co., of Worcester, Mass.

DAVID L. GRAY, who retired as vice-president of the Erie Railroad several years ago, has resumed his former association with the organization. Mr. Gray had been associated with the New York Central Railroad since 1918.

E. D. HERRICK has been appointed chief engineer of the Lycoming Motors Corporation, of Williamsport, Pa. J. M. Stout, chief tool designer for this company, has been appointed to assist Mr. Herrick.

GEORGE E. STECK, purchasing agent of the Diebold Safe and Lock Co., of Canton, Ohio, has resigned. He will be succeeded at the Diebold plant by Harold Shade, formerly of the Timken Roller Bearing Co.

FRED C. LANTSBERRY, managing director of William Jessop & Sons, Ltd., manufacturers of tool steel in England, accompanied by F. C. Woods, president of the United States branch of the firm, has been touring Canada.

GEORGE C. WALLER has been appointed manager of the railway department of the Dominion Power and Transmission Co., Hamilton, Ontario.

C. G. BOWKER, general manager of the central region of the Canadian National Railways, with headquarters at Toronto, has been appointed general manager of the Grand Trunk Western Lines, including all lines owned and operated by the Canadian National Railways west of Detroit and the St. Clair river. Mr. Bowker succeeds H. E. Wittenberger, who is retiring after many years of service.

HORACE C. KNERR has resigned as chief metallurgist at the United States Naval Aircraft Factory and has established an office at 1500 Green St., Philadelphia, where he will engage in business as a consulting metallurgical engineer.

L. DUNLEVY has been appointed sales manager of the Climax Engineering Co., of Clinton, Iowa. Mr. Dunlevy was formerly works manager.

FRANK R. SCHUBERT has been appointed general manager of the Strom Ball Bearing Co., of Chicago.

F. J. KOLB has been appointed vice-president and general manager of the Selden Motor Truck Corporation. He will be in charge of the New England territory, with headquarters in Boston.

VICTOR H. FINDLAY has been appointed manager of the Genesee-Durant Co., of Flint, Mich. Mr. Findlay was formerly associated with the Studebaker Corporation.

K. E. KARLSON, works manager of the Cleveland Automobile Co., of Cleveland, is visiting in Europe.

CHARLES S. PROUDFOOT has been appointed general manager of the United States Ferro Alloys Corporation, which is a division of the Vanadium Corporation of America.

B. H. MILLER has resigned as production manager of the United Alloy Steel Corporation, of Canton, Ohio.

A. D. MERWIN has joined the sales organization of the Bridgeport Brass Co., as manager.

E. T. MCCLEARY has been appointed assistant to the vice-president of the Youngstown Sheet and Tube Co., of Youngstown, Ohio.

E. P. BLANCHARD, advertising manager of the Bullard Machine Tool Co., of Bridgeport, Conn., has been appointed assistant sales manager of the company.

E. A. SPRING has resigned as manager of the Globe Foundry and Machine Co., of Globe, Ariz., and has become associated with the Capital Foundry Co., of Phœnix, Arizona.

J. V. W. REYNDERS, president of the American Institute of Mining and Metallurgical Engineers, has been appointed by Secretary of Commerce Hoover to consider the reorganization of the Bureau of Mines with Department of the Interior in the Department of Commerce.

R. T. Rice, who represents the Goddard & Goddard Co., of Detroit, in Cleveland and Pittsburgh, has moved his office to Room 700, Prospect-Fourth Bldg., Cleveland.

E. J. FULLAM, secretary and treasurer, and W. F. SLOMER, general sales manager of the Fellows Gear Shaper Co., of Springfield, Vt., returned on July 31 from an eight-weeks' trip to Europe, where they visited the representatives of the Fellows Gear Shaper Co., in England, Belgium, Holland, France, Germany, Switzerland and Italy.

Obituaries

J. J. COLE, president and general manager of the Cole Motor Car Co., died at the Claypool Hotel, in Indianapolis, on Aug. 7.

EDWARD P. MERRILL, general manager of the British Empire Steel Corporation, died on Aug. 6, in Montreal, Canada. He was 53 years old.

WILLIAM MCCONWAY, president of the McConway & Torley Co., of Pittsburgh, died on July 28.

WILLIAM O. DUNTLEY, former president of the Chicago Pneumatic Tool Co., and more recently president of the W. O. Duntley Co., of Chicago, died on July 27. He was 58 years old.

AMOS N. WHITELEY, one of the original partners of the Whiteley Malleable Castings Co., of Muncie, Ind., died on Aug. 3.

MAJOR GEORGE Q. WHITNEY, brother of Amos Whitney, and who was one of the founders of the Pratt & Whitney Co., died recently at his home in Hartford, Conn. He was 83 years old.

Pamphlets Received

Grinding Machine Information. Published by the Norton Co., Worcester, Mass. This booklet explains the grain sizes and grades of grinding wheels and the Norton methods of testing for safety. Suggestions are given for proper mounting and proper operating speeds in addition to useful rules for the calculation of the speed of wheels.

Master Specifications. Published by the Bureau of Standards, Washington, D. C., Circular 255 describes the material and requirements for cheesecloth for wiping purposes. Circular 258 gives the requirements for unbleached cheesecloth. Circular 264 lists the specifications for sterilized white cotton rags for wiping machinery. Circular 267 contains the requirements for wiping cloths in general.

Trade Catalogs

Fans and Blowers. American Blower Co., Detroit, Mich. Form No. 1929, entitled the Dealer's Pocket Price Book, sketches the uses and methods of ventilating systems, and gives a complete price list of blowers, fans and their accessories.

Bulletin No. 3506 is a 28-page treatment of the type "E", "ABC" steel-plate exhaust fans. Several pages are devoted to a discussion of the details of construction and the uses of the types of fan wheels available. The remainder of the bulletin is devoted to the results of tests made in accordance with the provisions of the Standard Code for exhausting fans, and to the specifications for the type "E" fans.

Form No. 3118, addressed primarily to heating contractors discusses the Venturafin method of heating, with illustrations of many installations. Diagrams show typical layouts for large buildings.

Elevators, Portable and Stationary. New Jersey Foundry & Machine Co., 90 West St., New York, N. Y. Catalog No. 106, 8 x 11 inches, is a 40-page description of the several types of elevators manufactured by this company. Nine pages are devoted to photographs of the elevators in use.

Pillar Presses. Nietzsche & Co., 510 Turks Head Bldg., Providence, R. I. A 6-page booklet gives the specifications of the No. 12 and No. 14 presses with a description of the details of construction in each.

Gears. Charles Bond Co., 617 Arch St., Philadelphia, Pa. Catalog No. 42. This book, 225 pages in length, lists the styles, types and sizes of the Bond standard stock gears in addition to information and data. The types of stock gears included are brass, iron and steel spur gears, internal, bevel, miter, worm, sprocket and spiral gears. The spur gears are made also of either rawhide or textolite. Complete specifications are given with comparative diagrams of involute profiles. The catalog, in addition to the line of stock gears, covers chain drives, speed reducers, universal joints, couplings, ball bearings and castings. Thirty pages contain much information and many useful data tables.

Bushings. Buckeye Brass & Manufacturing Co., Cleveland, Ohio. The Buckeye bushings, obtainable in many sizes, are now permanently carried in stock. A circular lists the sizes and the prices for which these stock bushings may be had.

Grinding Wheel Stands. Norton Co., Worcester, Mass. A 20-page catalog has been published by the Norton Co. to describe the type S, Q and P stands. Complete specifications are given of the stands and of the accessories. Separate circulars are devoted to a single type of the grinding wheel stands.

Belt Fasteners. Flexible Steel Lacing Co., 4607-31 Lexington St., Chicago, Ill. Folder H. D. gives the prices, specifications and a general description of the Flexco H. D. fasteners. A table shows the proper sizes for specific needs.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

National Safety Council. Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

American Gear Manufacturers' Association. Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—There are prospects of steady output of pig iron for the next four months. Minimum quotation on No. 2 fdry. Southern, is off about 50c. per ton from July 31 level. Galvanized steel sheets and tin plates are about the most active items on the steel list at the present time; semi-finished market improving. Minimum quotation on steel shapes down to $1.75 per 100 lb., Pittsburgh, against $1.85 on July 31. The minimum on plates is $1.80 per 100 lb., compared with $1.85 formerly. Both quotations apply on exceptionally large tonnages as bulk of sales is at $2 per 100 lb. on shapes and $1.90 for plates, f.o.b. mill. Bars hold firmly to the $2 level.

Non-Ferrous Materials—Copper and tin up ¼c. per lb.; lead and zinc advanced ⅛c. in New York warehouses during week ended Aug. 7. Antimony down about ⅜c. per lb. from July 31 level. Advancing trend of non-ferrous metals market reflected in higher quotations on fabricated materials. Slight fluctuation in linseed oil, wiping cloths and abrasives.

(All prices as of Aug. 7)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.

Detroit	5.00
Cleveland	4.90@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.30@2.40	3.89	3.10	3.50
No. 12	2.35@2.45	3.94	3.15	3.55
No. 14	2.40@2.50	3.99	3.20	3.60
No. 16	2.50@2.60	4.09	3.35	3.70
Black				
Nos. 17 to 21	2.95@3.00	4.15	3.70	3.80
Nos. 22 to 24	3.00@3.05	4.20	3.75	3.85
Nos. 25 and 26	3.05@3.10	4.25	3.80	3.90
No. 28	3.15@3.20	4.35	3.90	4.00
Galvanized				
Nos. 10 and 11	3.20@3.25	4.35	4.10	4.00
Nos. 12 to 14	3.30@3.35	4.45	4.20	4.10
No. 16	3.45@3.50	4.60	4.35	....
Nos. 17 to 21	3.60@3.65	4.75	4.50	4.40
Nos. 22 to 24	3.70@3.80	4.90	4.65	4.55
No. 26	3.90@3.95	5.05	4.80	4.70
No. 28	4.20@4.25	5.35	5.10	5.00

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	....	4.00@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	....	....
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 1/32, 8.25c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			60.25
Lead (up to carlots) E. St. Louis	9.50	New York	9.87½
Zinc (up to carlots) E. St. Louis	7.60	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.75	....	....
Copper sheets, base	22.25	22.50	22.25
Copper wire, base	19.75	16.75	16.25@16.50
Copper bars, base	21.37½	21.00	21.37½
Copper tubing, base	24.25	25.00	24.25
Brass sheets, base	18.62½	18.75	18.62½
Brass tubing, base	23.25	23.50	26.25
Brass rods, base	16.37½	16.37½	16.37½
Brass wire, base	19.12½	21.12½	19.12½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	11.50	10.75
Solder (½ and ½), (case lots)	39.50	38.00	40.00
Babbitt metal (83% tin)	60.00	69 25	60.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
		Cold rolled sheets (base)	50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@13.75	12.00	11.50@12.00
Copper, heavy, and wire	11.75@12.25	11.75	11.25@11.75
Copper, light, and bottoms	10.00@10.25	9.75	9.50@10.00
Heavy lead	7.37½@7.62½	6.75	7.00@ 7.50
Tea lead	6.00@ 6.25	4.25	6.50
Brass, heavy, yellow	7.25@ 7.75	7.25	7.50@ 8.00
Vrass, heavy, red	8.00@ 8.25	9.50	8.50@ 9.00
Brass, light	6.00@ 6.50	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.00@ 8.25	7.75	8.00@ 8.25
Zinc	4.50@ 5.00	4.00	4.25@ 4.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9 50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.18
Cotton waste, colored, per lb.	.10@ .15½	.18	.17
Wiping cloths, 13¼x13¼, per lb	.17	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.06	1.14	.96@1.00
Lard cutting oil, 25% lard, per gal.	.55	.50	.72
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	40%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	50 5%
Second grade	50–10–5%	60–5%	50–10–5%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold finished shafting	per lb.	.0415	.0415	.0415
Brass rods	per lb	.1637½	.1587½	.145
Solder (½ and ½)	per lb.	.395	.395	.375
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.40
Cloth	3.55	2.67	3 55
Fire clay, per 100 lb. bag	.....	.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.90@3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs		New York, 15.75
Red lead, dry	100 lb. kegs		New York, 15.75
Red lead, in oil	100 lb. kegs		New York, 17.25

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{9}{16}$-in. and smaller and 65% for ¾-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¾ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Dorchester (Boston P. O.)—H. Klayman, 39 Wilcox St.—miscellaneous repair tools and equipment for extensive service garage on Neponset Ave.

Mass., Winchester—J. Haggerty, 736 Main St.—miscellaneous tools and equipment for garage and repair shop.

Mass., Worcester — Building Dept., City Hall—manual training equipment for Commercial High School.

Mo., Kansas City—Anderson Pitt Corporation, 2609 Walnut St.—machinery for the manufacture of reflector heaters.

Mo., St. Louis—B. H. Tontrup, 3639 Olive St.—tinners brake folder and wiring.

N. Y., New York—W. Martin, 43 Cooper Square—1¼ in. hollow spindle wood turning lathe.

O., Columbus—F. H. Lawwell Co., 1170 Mt. Vernon Ave.—18 in. lathe, drill press, air compressor, grinder, etc., for service station.

O., Columbus—Majestic Coal Co., 16 East Broad St., K. W. Rittenhouse, Pres.—loading and unloading equipment for new retail yard at 205 West Main St.

O., Fostoria—Fundoa Hoist & Shovel Co. (manufacturers of hoists, shovels, etc.)—lathes, grinders, gear cutters, etc.

Okla., Tulsa—Blackgold Machine & Mfg. Co., R. F. D. Box 824, Foster—equipment, including lathes, drills, sharpeners, etc., for plant here.

Tex., San Antonio—Krueger Machinery Co., East Houston St.—additional machinery for the manufacture of oil well, irrigation, ginning and refrigerating machinery for plant at San Jose near here.

Wis., Prairie du Chien—The Emmons Handle Co.—machinery for the manufacture of tool handles to replace fire loss.

Ont., London—London Box & Lumber Co., T. H. Baker—complete woodworking equipment for box making, dovetailing, etc., to replace fire loss.

Que., Amos—F. Blais—general saw mill machinery.

Que., Privat—C. St. Pierre—band saw, planer.

Que., St. Celestin—A. Poirier—drum saw, cut off saw and other sawmill equipment.

Australia, Melbourne—Victoria Government Railways—will receive bids until September 16th for 1 forging machine and hot saw attachment, 3 pneumatic power hammers and 3 compressed air or steam hammers including tools and accessories.

Opportunities for Future Business

Conn., New Britain — F. Beloin, Beloin Hotel, is having plans prepared for the construction of a 2 story, 75 x 100 ft. garage with 70 x 100 ft. wing on Church St. Estimated cost $150,000. Storrs & Feinberg, 1127 Main St., Hartford, Archts.

Ill., Elgin—Elgin Wind Power & Pump Co., 75 North State St., awarded contract for the construction of a 3 story, 36 x 46 ft. addition to plant. Estimated cost $40,000.

Ill., Peoria—J. W. Bushell, 1321 South Washington St., awarded contract for the construction of a 1 story, 140 x 143 ft. show room and service station at Pecan and Washington Sts. Estimated cost $72,000.

Kan., Wichita—Coleman Lamp Co., 220 North St. Francis St., awarded contract for the construction of a 4 story, 60 x 90 ft. plant. Estimated cost $50,000.

Mass., Brookline (Boston P. O.)—Young Bros., 18 Webster St., plan the construction of a 1 story repair and service garage on Lawton St. Estimated cost $100,000. Architect not selected.

Mass., Chelsea (Boston P. O.)—Gordan & Gerber, 20 Sumner St., is receiving bids for the construction of a 1 story, 60 x 150 ft. metal working plant on Spruce St. Estimated cost $40,000. S. S. Eisenberg, 46 Cornhill St., Boston, Archt. Noted Aug. 6.

Mass., Dorchester (Boston P. O.) — S. Spector, 31 York Terrace, will build a 1 story, 200 x 230 ft. repair and service garage at Charles and Middlesex Sts. Estimated cost $80,000. C. F. Springhall, 50 Concord St., Malden, Archt.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Mo., Kansas City — Schutte Investment Co., 3015 South West Blvd., will soon award contract for the construction of a 3 story, 85 x 183 and 50 x 56 ft. garage and sales room at 26th and Grand Ave. Estimated cost $150,000. R. H. Sanneman, 519 Lee Bldg., Archt.

Mass., Lowell—T. E. Parker, 142 Chestnut St., awarded contract for the construction of a 2 story, repair and service garage on East Merrimac St. Estimated cost $50,000. Noted July 30.

Mass., Roxbury (Boston P. O.)—D. Breckman, 43 Tremont St., Boston, is receiving bids for the construction of a 1 story, 50 x 200 ft. repair and service garage at 635 Warren St. here. Estimated cost $40,000. M. J. Allen Inc., Archt.

Mass., Wakefield—Neveroil Bearing Co., Foundry St., awarded contract for the construction of a 1 story plant. Estimated cost $40,000.

Mass., Worcester — Building Dept., City Hall, is having plans prepared for the construction of Commercial High School including manual training room, etc. on Walnut St. Estimated cost $1,000,000. G. C. Halcott, 7 Shepard St., Archt.

Mich., Detroit—Hupp Motor Car Corporation, 3501 East Milwaukee St., awarded contract for the construction of building No. 8. Estimated cost $150,000.

Mich., Detroit—Packard Motor Car Co., 1580 East Grand Blvd., awarded contract for additions and alterations to present buildings and construction of a 1 story, 85 x 150 ft. export shipping building. Estimated cost $100,000.

N. H., Beebe River—Draper Corporation, Hopedale, Mass., awarded contract for the construction of a 1 story plant for the manufacture of textile machinery, here. Estimated cost $40,000.

N. C., Raleigh—Carolina Power & Light Co., P. A. Tillery, Gen. Mgr., plans the construction of a 1 story car barn, shop and garage. Estimated cost $86,000.

O., Barberton—Ohio Insulator Co., plans the construction of two new factory units. Estimated cost $40,000 to $50,000.

O., Cleveland—The Chisholm-Moore Co., 4556 Lakeside Ave., awarded contract for the construction of a 1 story, 54 x 63 ft. annealing room. Estimated cost $40,000.

O., Columbus—F. H. Lawwell Co., 1170 Mt. Vernon Ave., will soon receive bids for the construction of a 2 story, 60 x 144 ft. sales and service station at St. Clair and Mt. Vernon Aves. Estimated cost $65,000.

Okla., Tulsa—Blackgold Machine & Mfg. Co., R. F. D. Box 824, Foster—plans the construction of a group of buildings here. Private plans.

Pa., Elizabethtown — E. A. Wightman, Bankers Trust Bldg., Philadelphia, Archt., will receive bids until August 18th for the construction of 1 and 2 story, 128 x 212 ft. shop buildings at Masonic Home for Thomas Patton Rankin Memorial School for Boys.

Tenn., Chattanooga—Crane Enamelware Co., 1316 Chestnut St., plans the construction of a foundry and grinding building. Estimated cost $200,000.

Tenn., Lenoir City—Lenoir Car Works Co., Z. B. Wilson, Mgr., plans the construction of steel shops to replace fire loss. Estimated cost $500,000.

Wis., Neopit—Menominee Indian Tribe, E. A. School, Asst. Supt. of Reservation, awarded contract for the construction of a 2 story, 66 x 95 ft. saw mill.

Wis., Port Washington—Kwik Mix Concrete Mixer Co., 126 Milwaukee St., awarded contract for the construction of a 1 story, 48 x 146 ft. foundry. Estimated cost $40,000.